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OCTOBER
1938

Factory

Management and Maintenance

Public Relations for Industry

An editorial service to meet industry's major problem

Handling in Ford's Tire Plant

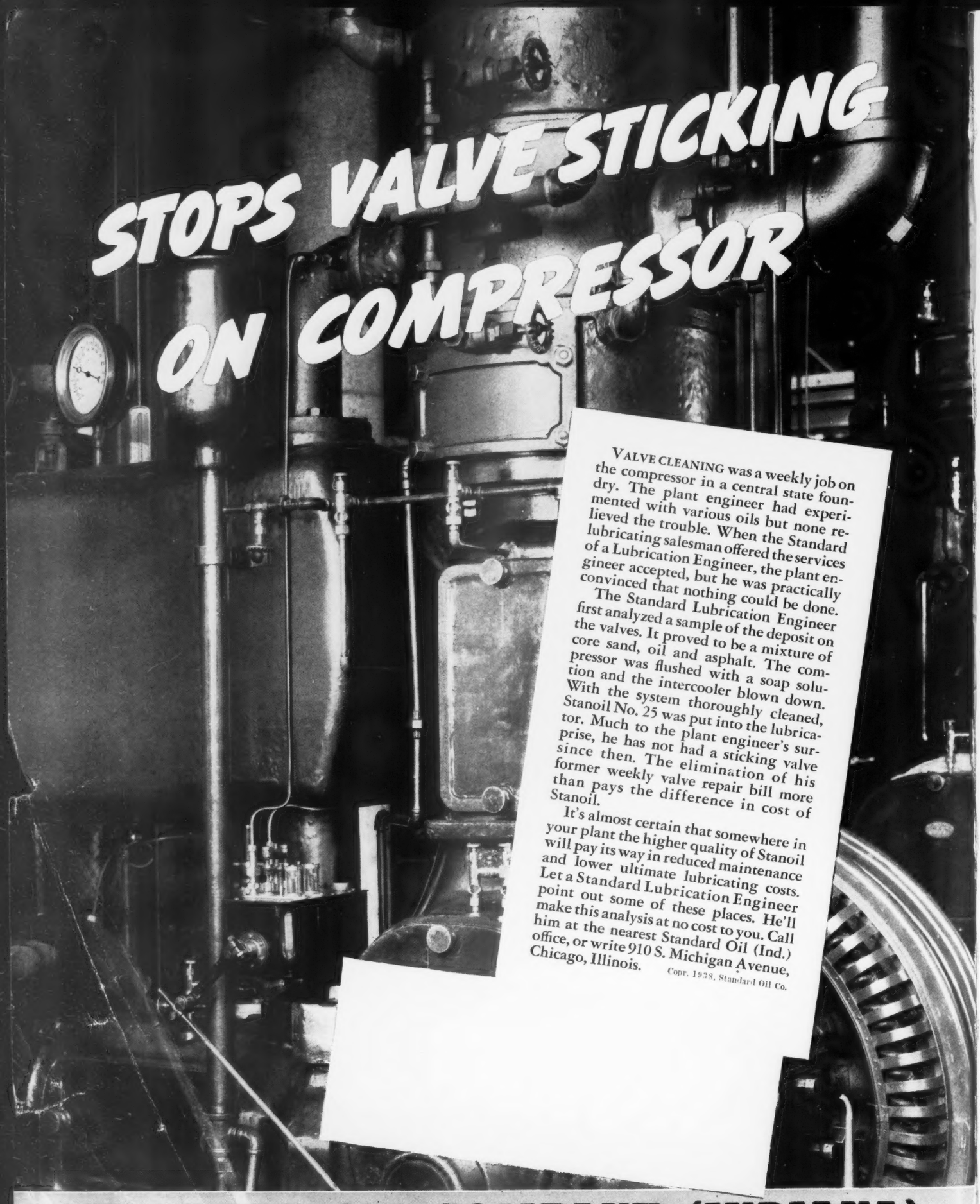
Lubrication on Incentive Wage

Social and Economic Aspects of Management

Excerpts from selected papers presented at the Seventh International Management Congress

141.488

McGRAW-HILL PUBLISHING COMPANY, INC.



STOPS VALVE STICKING ON COMPRESSOR

VALVE CLEANING was a weekly job on the compressor in a central state foundry. The plant engineer had experimented with various oils but none relieved the trouble. When the Standard lubricating salesman offered the services of a Lubrication Engineer, the plant engineer accepted, but he was practically convinced that nothing could be done.

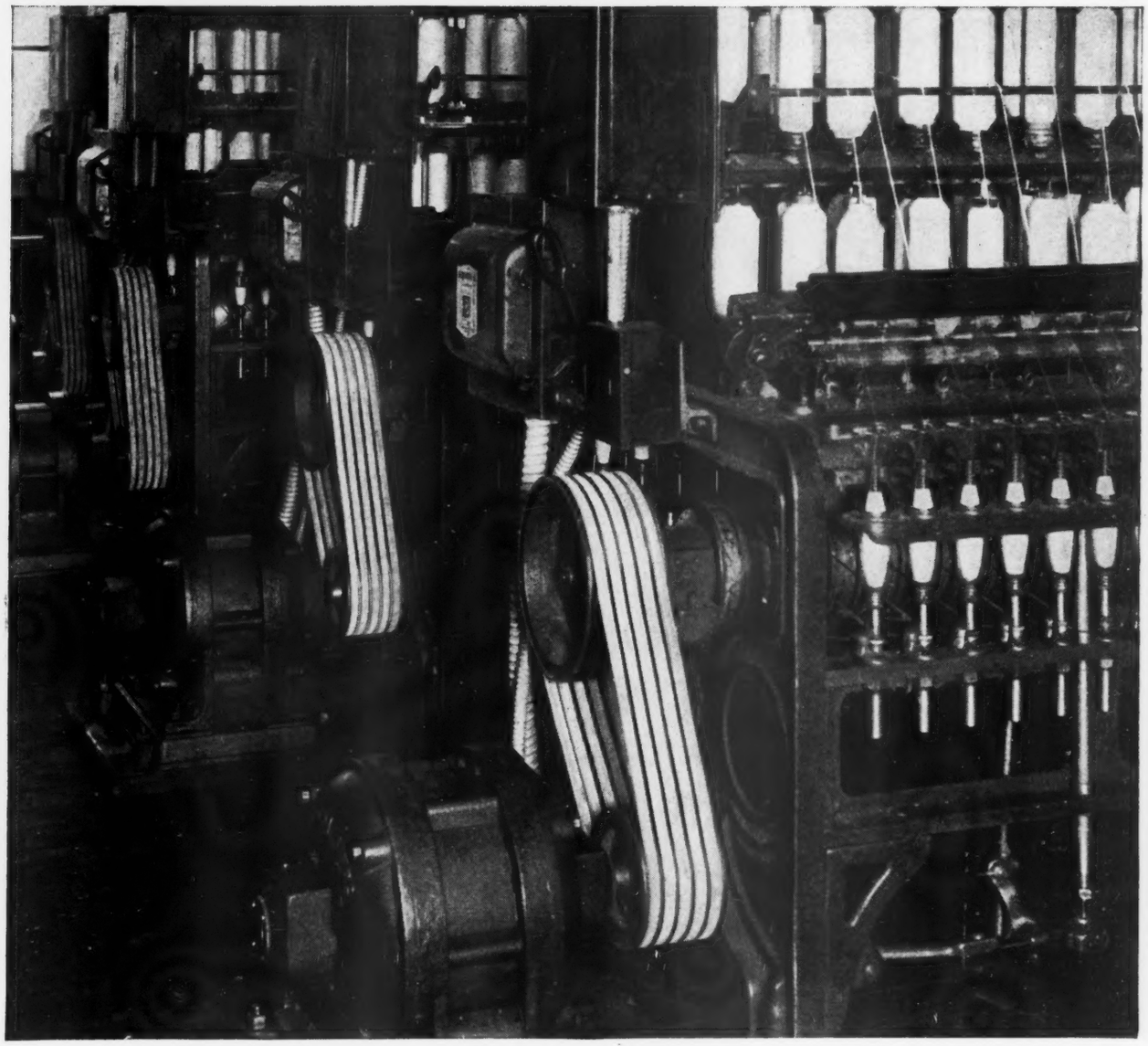
The Standard Lubrication Engineer first analyzed a sample of the deposit on the valves. It proved to be a mixture of core sand, oil and asphalt. The compressor was flushed with a soap solution and the intercooler blown down. With the system thoroughly cleaned, Stanoil No. 25 was put into the lubricator. Much to the plant engineer's surprise, he has not had a sticking valve since then. The elimination of his former weekly valve repair bill more than pays the difference in cost of Stanoil.

It's almost certain that somewhere in your plant the higher quality of Stanoil will pay its way in reduced maintenance and lower ultimate lubricating costs. Let a Standard Lubrication Engineer point out some of these places. He'll make this analysis at no cost to you. Call him at the nearest Standard Oil (Ind.) office, or write 910 S. Michigan Avenue, Chicago, Illinois.

Copr. 1928, Standard Oil Co.

STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING *THE RIGHT LUBRICANT • PROPERLY APPLIED TO REDUCE COSTS*



The First Quintuplets—in Belts

A typical example of Goodrich improvement in rubber

YEARS ago Goodrich designed a belt shaped like a "V," to drive the fan on your car. Allis-Chalmers engineers devised a way of using these belts in multiple and they proved so efficient that industry applied them to many kinds of machines.

But no one ever discovered a way to make them exactly alike in length under load. A group of belts might measure the same relaxed but not when under tension. Out of any group two or three would be longer, and so idle around the drive, while the shorter, tighter belts carried the load, and so wore out quicker.

All sorts of devices were tried to arrive at sets of matched belts, of exactly equal lengths, but none was successful.

Then Goodrich engineers went to work, and now for the first time you can buy matched sets of V-belts—as exact as matched golf clubs—each belt sure to carry its full share of the load. The Goodrich development is a machine which automatically measures the belt while it is running under full load. Its length registers on a dial, and is at once stamped on the belt. Then matched sets are assembled.

Again Goodrich research and development give industry a new and better value—the same Goodrich research which has for years been developing new rubber compounds, new fabrics, new combinations and applications of the two—and so developing belting, hose, packing, rolls, tank linings, and hundreds of other rubber products which give you more for your money because they last longer and meet your needs better. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

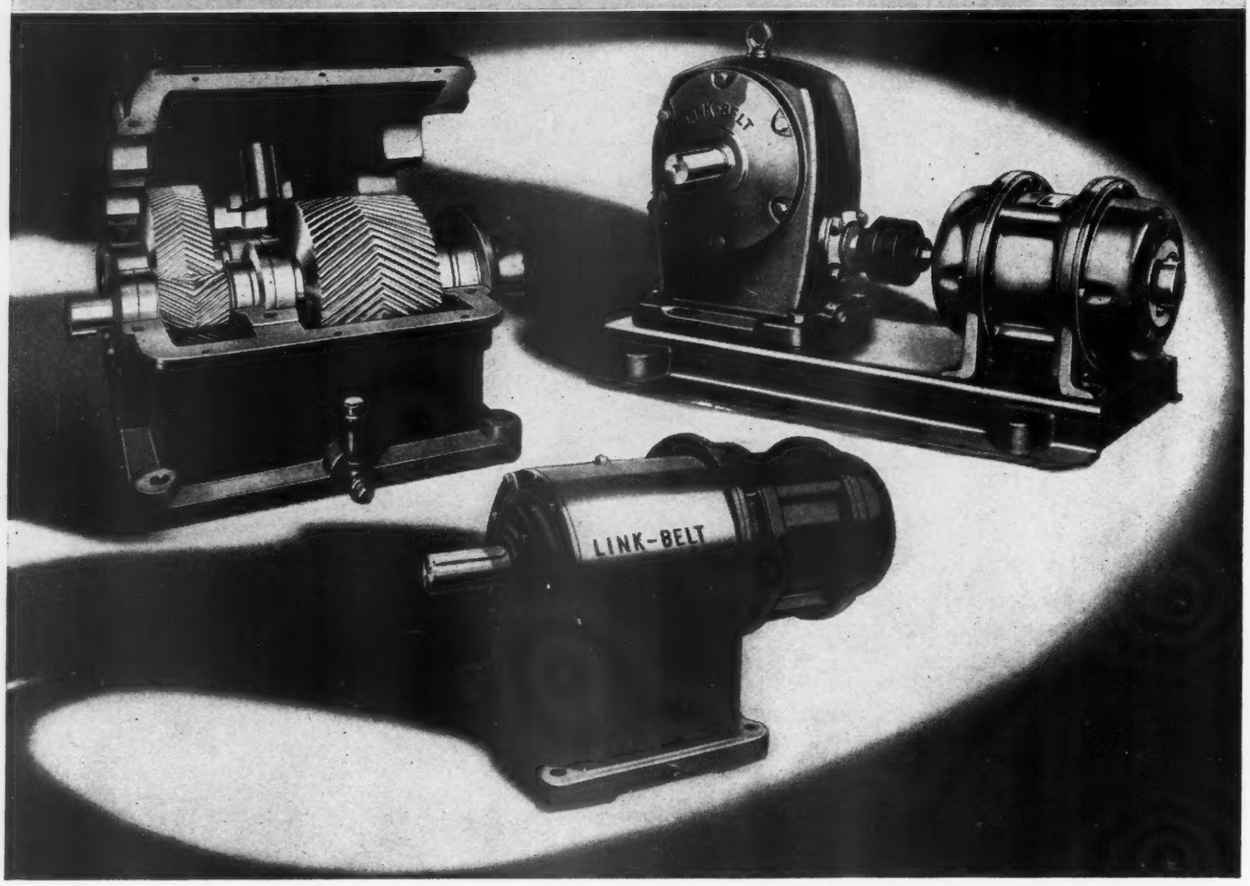
Goodrich

ALL *products problems* IN RUBBER

LINK-BELT

Speed Reducer Service

is UNBIASED *and* COMPLETE



● The three improved types of reducer units included in the Link-Belt line — Herringbone Gear, Worm Gear, and Motorized Helical Gear — meet today's needs for the dependable transmission of power at accurate speeds.

They are built in a large variety of sizes, ratios and horsepowers. Call in a Link-Belt positive drive specialist to help you select the most efficient unit for your requirements. Send for catalogs on these and other Link-Belt positive drives.

THE SYMBOL OF QUALITY · LB · LINK-BELT

LINK-BELT COMPANY 437

The Leading Manufacturer of Positive Power Transmitting Equipment

INDIANAPOLIS, Dodge Plant, 519 N. Holmes Ave. CHICAGO, Caldwell-Moore Plant, 2410 W. 18th St. INDIANAPOLIS, Ewart Plant, 220 S. Belmont Ave.
CHICAGO Plant, 300 W. Pershing Rd. PHILADELPHIA Plant, 2045 W. Hunting Park Ave. SAN FRANCISCO Plant, 400 Paul Ave.
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Baltimore . . Boston . . Buffalo . . Cleveland . Dallas . Denver . Detroit . Grand Rapids . . Houston . Huntington, W. Va. . . Kansas City, Mo. . . Los Angeles . . Louisville
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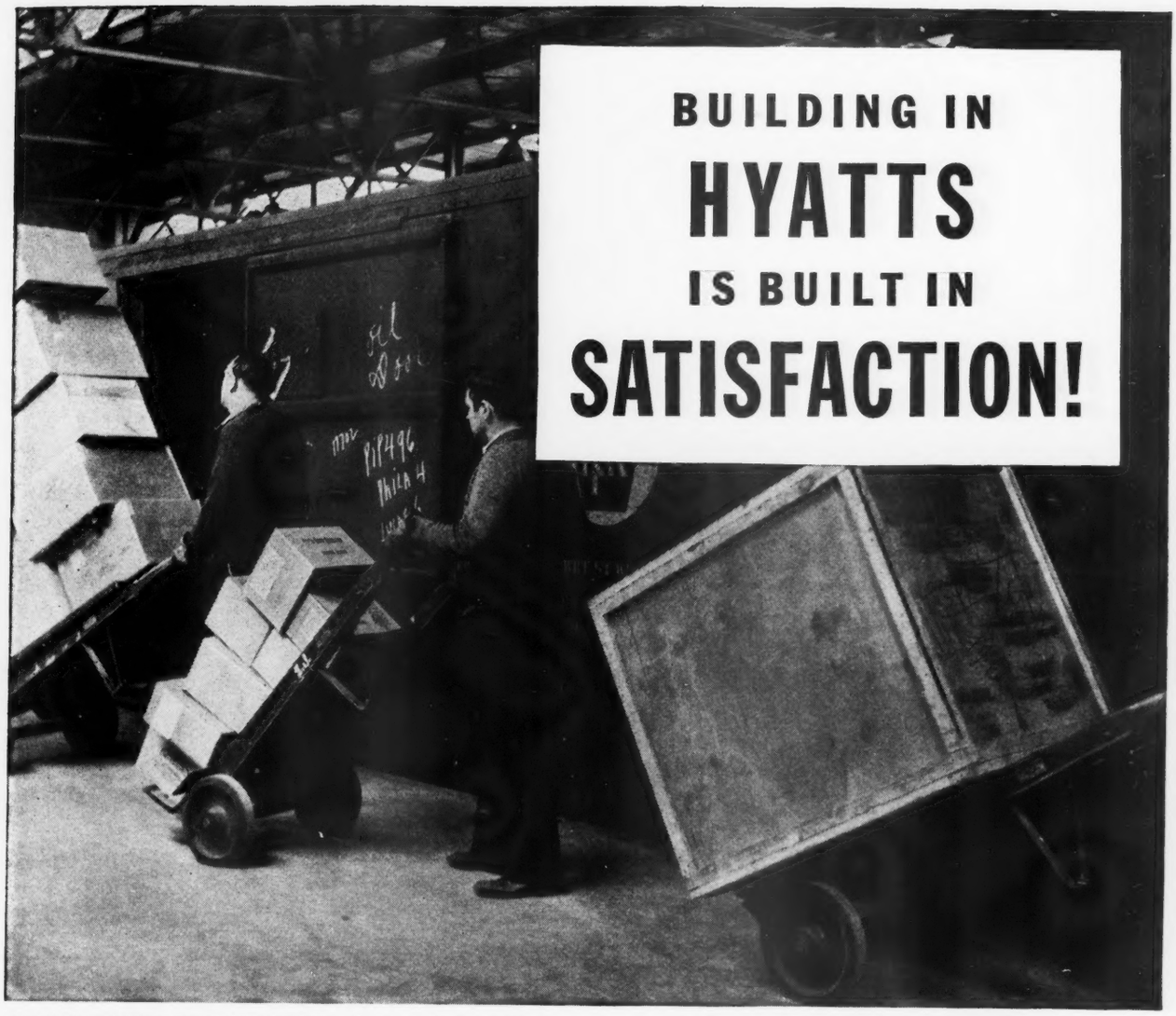
In Canada—Link-Belt Limited—Toronto Plant; Montreal; Vancouver.

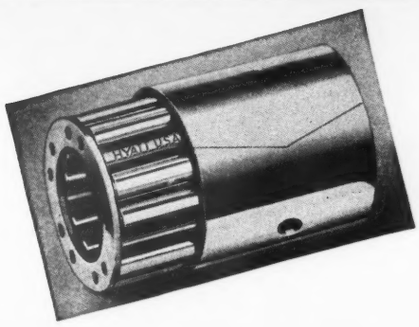
FACTORY MANAGEMENT and MAINTENANCE (a consolidation of Factory and Industrial Management (including "Factory") and Maintenance Engineering), Oct., 1938, Vol. 96; No. 10. Published monthly. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42d Street, New York, N. Y. Entered as second class matter, November, 1936, at Post Office, Albany, N. Y., under the Act of March 3, 1879. Price 35c a copy. Subscription rates—United States, Canada, Mexico, and Central and South American countries, $3 a year. All other countries, $4 a year or 16 shillings.



BUILDING IN HYATTS IS BUILT IN SATISFACTION!

AMERICAN PRESSED STEEL HAND TRUCKS built by the American Pulley Company are typical of the many types of material handling equipment into which Hyatts are built for better performance.

CORRECT design, precision manufacture, and sound application of Hyatt Roller Bearings play a big part in that excellence of machine construction and performance which buyers accept with utmost confidence. No wonder more and more equipment builders are turning to Hyatt Roller Bearings. With Hyatts they know that strength, endurance, smooth operation, freedom from friction and wear are in-built . . . advantages that lengthen the life of every vital bearing position under their protection. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J., and San Francisco. Hyatt Roller Bearing Sales Company, Chicago and Pittsburgh.



HYATT ROLLER BEARINGS

Safety Features

THAT MAKE MOTOR-DRIVE MORE THAN POWER

. . . AND HELP BOOST THE PRODUCTION RATE

Wire Drawing is Safer. The automatic electrical safety device on this Vaughn wire-drawing block operates so easily and positively that the machine stops instantly in case of trouble. This is one reason for an improved safety record in the wire industry. . . . A slow pulling-in speed is provided for starting the rod through the die and until a few turns are made on the reel.

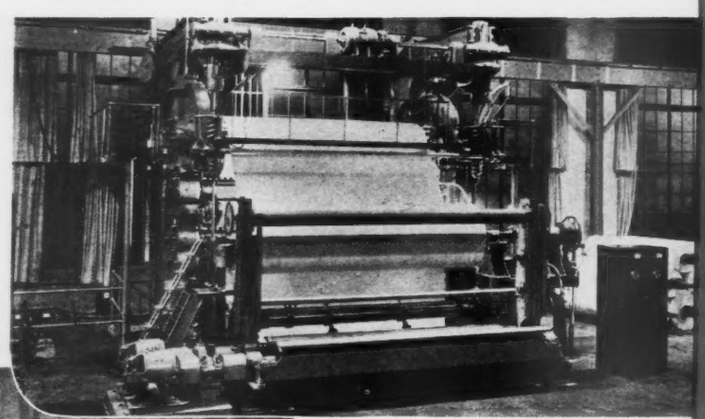
Men do things quicker on machines like these when they can go about their work with an assurance of safety. Check these applications and see how the electric motor has been made the foundation point for safe operation. It plays its full part in production.

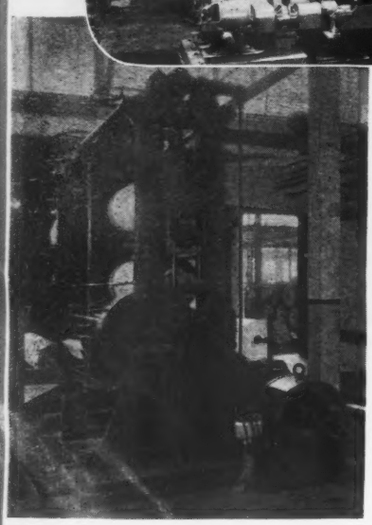
You know the things that you want to do when planning such applications; it's our business to know how many you can do best with motors and control. A little mental teamwork between you and a Reliance man should prove helpful. Why not try it? You will find capable engineers ready to serve you in the offices listed below.

Reliance Electric & Engineering Co.

1088 Ivanhoe Road Cleveland, Ohio.

Branches: Birmingham, Boston, Buffalo, Chicago, Cincinnati, Detroit, Greenville (S. C.), New York, Philadelphia, Pittsburgh, Syracuse (N. Y.). Representatives in other principal cities.



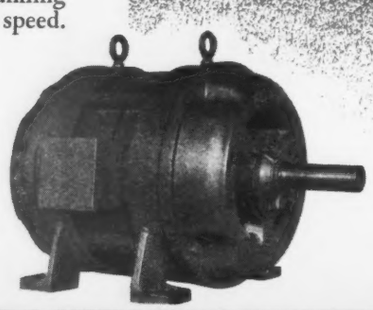


High Speeds with Safety. Paper travels at a top speed of 1480 f.p.m. through this super-calender but the rolls can be stopped quickly but smoothly by regenerative braking of the 200 hp. main drive motor. Four emergency "stop" buttons are placed about the calender. . . . Threading paper into the rolls is done in safety by running the motor at a slow speed.

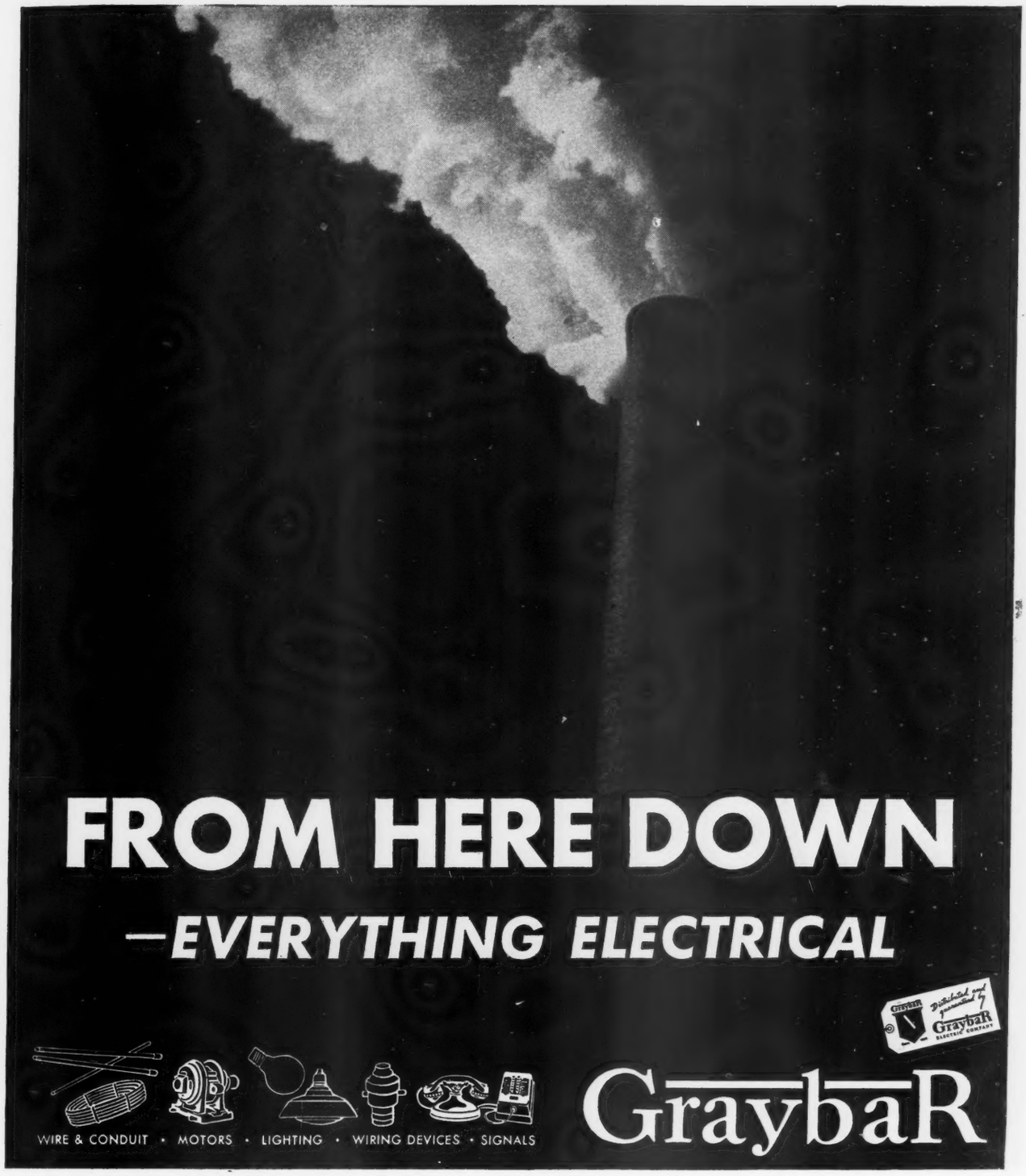
Safe Threading. For safety and ease of handling when threading a new roll of cloth into this calender, the motor is run very slowly. A separate "inch" button on the push-button station is used for this purpose. . . . Pressing the "slow" button brings the motor to a speed suitable for cloth inspection. When the "stop" button is depressed, the calender comes to a standstill quickly by graduated dynamic braking.

Type T Heavy-duty D-c. Reliance Motor

Type AA Reliance A-c. Induction Motor →



RELIANCE A-C D-C MOTORS



FROM top to bottom, from one end of a factory to the other . . . every electrical need can be supplied by Graybar. Whatever the item . . . a fuse, a motor, or a reel of cable . . . you'll find it quickly and conveniently available at a nearby Graybar warehouse.

Let Graybar's experienced specialists help you plan for greater efficiency with up-to-date wiring and power layouts...better lighting...convenient unit ventilation . . . time-saving signals.

Graybar's list of 60,000 items blankets the entire electrical industry. Whenever an electrical supply problem of any kind arises, write . . . or pick up your phone . . . and get Graybar.

OFFICES IN 85 PRINCIPAL CITIES. EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK

"Sure, changing to GULF'S *higher quality lubricants* has increased our oil bill $20,000 this year...

but...WITH BETTER LUBRICATION *we've cut maintenance costs $200,000!"*

"We've made a big operating saving," says this Vice President, "but that's not the whole story. With Gulf's higher quality lubricants protecting our equipment, *we're giving our customers better service.*"

The dollars and cents savings which result from proper lubrication are important to plant men who strive to operate machinery economically. But there are further benefits of equal importance. The annoyance of frequent shutdowns for repairs and adjustments—and resultant production losses—are avoided when Gulf's higher quality lubricants are applied as recommended by an experienced Gulf engineer. Production schedules are maintained, orders are filled promptly and customers get better service.

No matter what type of mechanical equipment you operate, better lubrication with Gulf's higher quality oils and greases can help you reduce maintenance costs and improve production.

Ask the Gulf engineer who calls at your plant to suggest possible means of placing your lubrication on a more efficient basis. You will not be obligated in any way, so take advantage of this money-saving service at once. Gulf Oil Corporation—Gulf Refining Company—Gulf Building, Pittsburgh, Pa.

GULF INDUSTRIAL LUBRICATION

(Reading time: 29 seconds or less)

● A 126% increase in production on a brushing operation is gained by using *the right brush for the job* in a plant manufacturing electric motors. Tests made to compare the efficiency of brushes used formerly with Osborn Brushes recommended for the work caused the manufacturer to standardize upon Osborn Brushes. The Osborn Brushes cost 12 cents more per section than the brushes used formerly, but the price differential was insignificant compared to the increased efficiency and longer life of the Osborn Brushes. It's good business to use good brushes *properly selected to match job requirements!*

Osborn and the Osborn Distributor in your locality can help YOU gain the cost saving advantages provided by Osborn Brushes. *Ask about it!*

THE OSBORN MANUFACTURING COMPANY • 5401 HAMILTON AVENUE • CLEVELAND, OHIO

HEATS ENTIRE PLANT *at 1/6 the Cost*

THE CINCINNATI SHEET METAL & ROOFING CO.
MANUFACTURERS — *Galvanized Roofing* — CINCINNATI · OHIO
AJAX BRAND

July 27th, 1938

Modine Manufacturing Company
Racine
Wisconsin

Gentlemen:

In December 1935 we installed a complete steam heating system in our plant consisting of fifteen #1163 and nine #903 Modine unit heaters.

You may be interested in knowing that these Modine heaters have proven a great success with us in a number of ways. Prior to installing the Modine units, which now enables us to heat our entire plant, we formerly were only heating about one-sixth of our space, using gas powered unit heaters, the balance of our plant being unheated. Since installing the steam heating system with Modine units, we find that we are now able to heat the entire plant at a fuel cost no greater than what it formerly cost us to heat about one-sixth of this space with gas heaters.

Of particular importance to us is the fact that with the Modine unit heaters we are now able to control or retard the condensation that formerly formed on our sheets, and which now enables us to keep our galvanized sheets bright and new in appearance. This is due to the fact that we are now able to maintain a constant temperature throughout our plant, and at the same time have sufficient air movement to keep the sheets dry and free from premature oxidation.

They also perform a worthwhile summer duty, inasmuch as they operate the units without steam, we therefore secure constant air movement resulting in more confortable working conditions.

Since we installed these Modine unit heaters almost three years ago we have not spent a cent for repairs or upkeep. Needless to say, we are very well pleased with the installation.

Very truly yours,

THE CINCINNATI SHEET METAL & ROOFING COMPANY

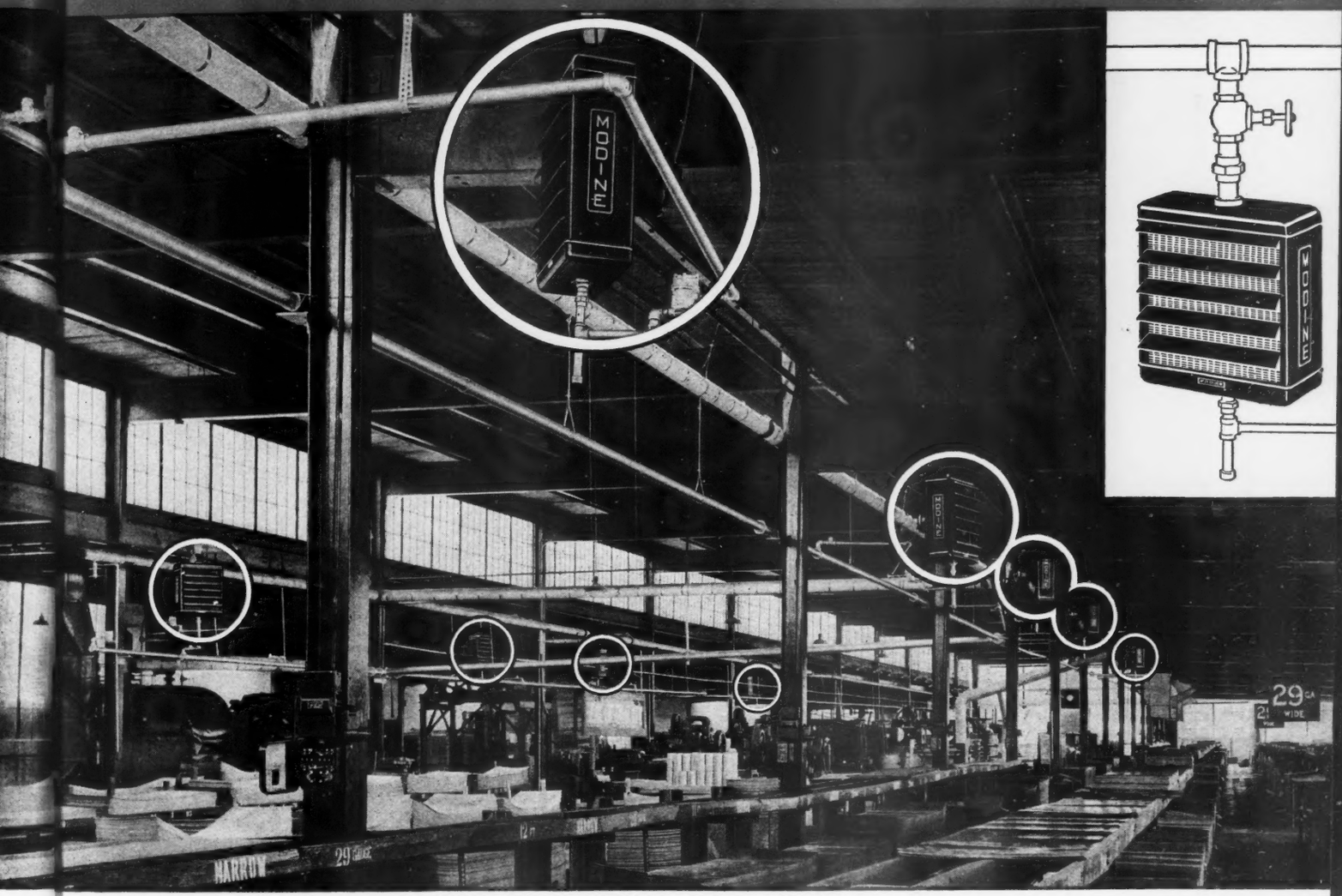
W. A. Moss
PLANT SUPERINTENDENT

W.A.MOSS:C

W. A. Moss, Plant Superintendent, The Cincinnati Sheet Metal & Roofing Company, Cincinnati, Ohio.

MODINE MANUFACTURING COMPANY, 1730 RACINE STREET, RACINE, WISCONSIN

with MODINE UNIT HEATERS



"Modine Heaters have proven a great success with us in a number of ways"

● Wouldn't you consider that heating an entire plant at one-sixth the former cost was reason enough for installing Modine Unit Heaters? Certainly you would.

Yet this is not exceptional. In factories, stores, offices, warehouses . . . hundreds of Modine users report similar experiences. Where direct radiation has been replaced, Modines have saved 15%, 25% and more, *in fuel costs alone.*

With design and construction advantages not found in other unit heaters, Modines are more effective in their fast, thorough and even heat distribution . . . more flexible in application . . . more accurate in control.

Modines step up production by maintaining constant temperatures for process operations. Their better heating keeps employees comfortable and healthy, cuts lost time, increases individual output.

Modines are stronger structurally—for longer life and lower upkeep. Note that Mr. Moss says, "not a cent for repairs or upkeep" in almost three years.

Modine-patented *direct-from-supply-line-suspension* not only saves valuable floor and wall space but makes your installation costs far lower.

Any unit heater manufacturer can make superlative claims. But outstanding performance cannot be promised into a unit heater. It has to be built in—*as Modine builds it in.* Actual records of Modine's unusual economy and superior service, and users' statements of satisfaction carry more solid weight than the finest sales talk. That's why *more Modines are sold than any other unit heater.*

This FREE BOOK Tells Why

Write for it

Modine Manufacturing Company,
1730 Racine St., Racine, Wis.

I want to know how to save 15 to 25% and more in fuel costs with Modine Unit Heaters. Without cost or obligation, send new descriptive catalog.

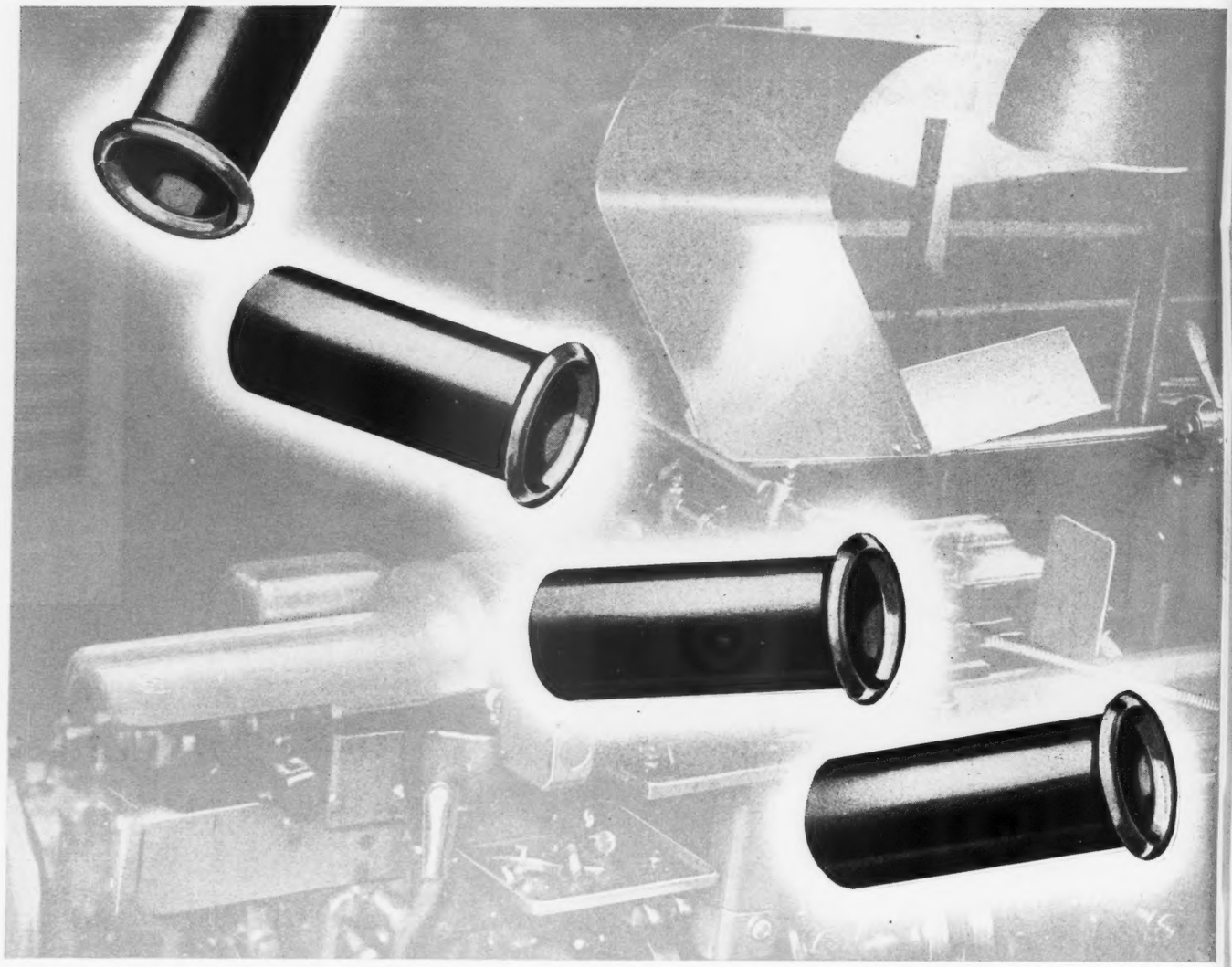
Individual_____

Firm_____

Street and Number_____

City_____ State_____

HEATING, COOLING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRIAL, COMMERCIAL AND



THE 8-POINT CUTTING OIL ASSURES:

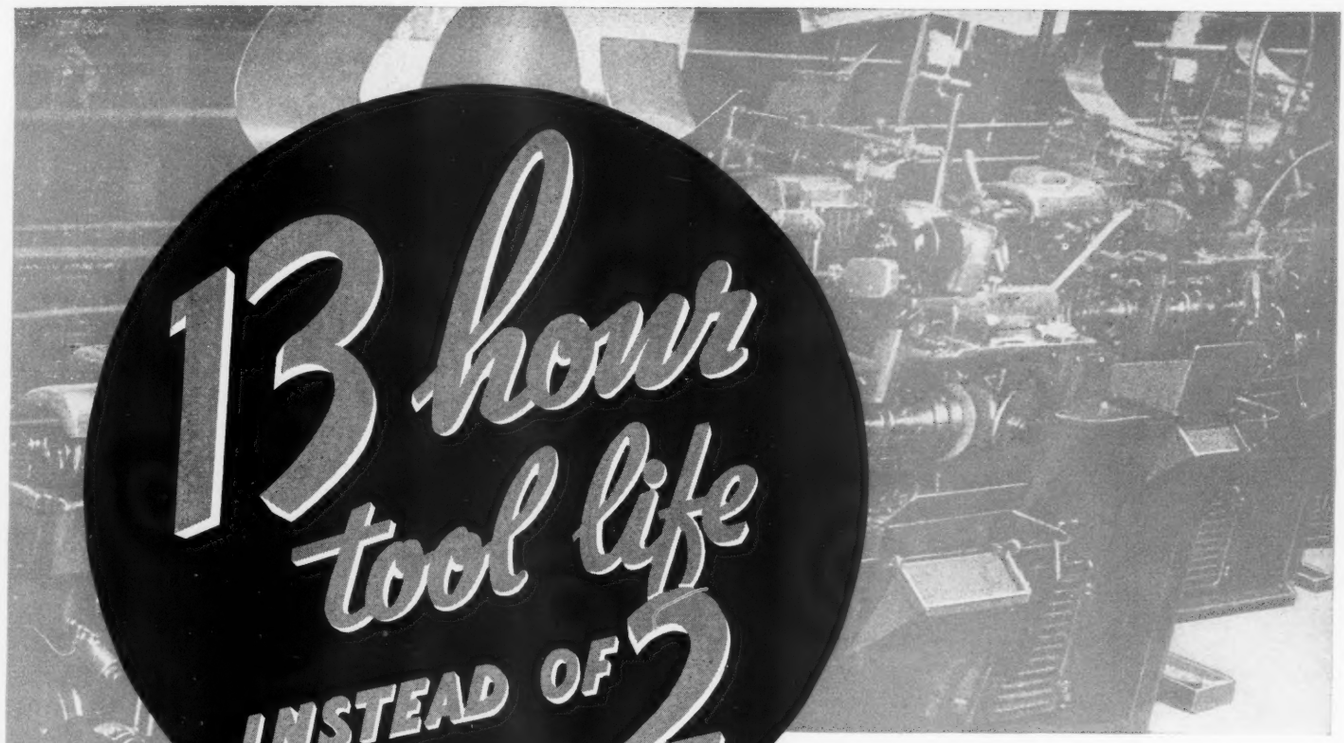
1. Non-corrosive, non-tarnishing to ferrous and non-ferrous metals.
2. High stability... will not turn rancid.
3. The sulphur is permanently incorporated in the body of the oil.
4. Color and clarity permit close inspection of work—without stopping machine operations.
5. Will not gum or form deposits on machine tool parts.
6. Minimum carry-off. Machine parts easily cleaned.
7. Readily miscible, can be blended cold with low-viscosity mineral oils.
8. Longer tool life and freer cutting.

Result: Maximum production . . . machining efficiency . . . and economy.

INDUSTRIAL TYCOL OILS-GREASES

TIDE WATER

THERE IS A COMPLETE LINE OF TYCOL LUBRICANTS



13 hour tool life INSTEAD OF 2

...when they switched to TYCOL CUTTING OIL

TIDE WATER CUTTING OILS INCLUDE:

1. Tycol Transparent Non-Tarnishing Sulphurized Oils
2. Tycol Sulphuretted Transparent Oils
3. Tycol Sulphuretted Dark Oils
4. Tycol Mineral-Lard Oil Blends
5. Tycol Soluble Cutting Oils

THE IDEAL OIL FOR EVERY CUTTING NEED

TURNING OUT these thimbles on automatics proved the outstanding value of Tycol transparent non-tarnishing sulphurized cutting oils. Not only was a six and one-half times increase in tool life secured, but there was an appreciable saving in cost. Similarly with an ever-increasing number of manufacturers the qualities of this 8-point Cutting Oil are reducing machining costs and improving finishes.

"Absence of tarnish on brass," reports one..."Six times the tool life," reports another..."100% finish!" says a third. Manufacturers are truly proving to their own satisfaction that the new Tycol Cutting Oils have every desirable quality.

No matter what your machining job may be, facts indicate that you can obtain actual dollars and cents savings. The combination of a full line of proved Cutting Oils and a sound knowledge of their proper application is at your service. Tide Water Associated Oil Company, Tide Water Division, 17 Battery Place, New York, N. Y.

TRANSPARENT NON-TARNISHING SULPHURIZED CUTTING OILS

SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE

MOTOR GENERATOR
COMBINATION GEARHEAD MOTORS
DOUBLE PARALLEL GEARHEAD MOTORS
ELEVATOR AND HOIST
EXPLOSION PROOF
D C GENERATOR
SLIP RING
SYNCHRONOUS
REPULSION INDUCTION
HORIZONTAL FLANGE
FLANGE MOUNTING
UNIBRAKE
RESILIENT MOUNTING
GAS PUMP MOTOR

MASTER

MAKES YOUR JOB EASIER

The broad line of Master Motors, which includes all styles and sizes from 1/10 to 100 HP., gives you an unusually wide selection from which you can easily choose the motor you need. Take advantage of the unusual ability of the Master organization to adapt any type motor you select, so that it meets EXACTLY your individual needs. Thousands of men like you have found this an easy way to secure the advantages of compactness, improved appearance and lowered costs.

THE MASTER ELECTRIC COMPANY
DAYTON, OHIO

SAFETY FIRST
Helping Industry
TO MAKE EMPLOYEES SAFE
Helping Employers
TO PROFIT FROM INSURANCE
0
25%
50%
75%
1926
1930
1937
FEWER ACCIDENTS TO WORKERS
61% drop in 12 years
Cents per $100 of Payroll
70
65
60
55
POLICYHOLDER'S AVERAGE ACTUAL RATE
AVERAGE MANUAL RATE FOR SIMILAR PLANTS IN SAME STATE
1933
1934
1935
1936
LOWER INSURANCE RATES FOR MANY AMERICAN MUTUAL POLICYHOLDERS

The average American manufacturing plant is a far safer place to work in than the average American farm. A man is less than half as likely to be killed inside a factory as to be killed in his own home. More people are killed in their own kitchens than by an industrial machine!

American Mutual — the first American liability insurance company—is proud that its safety services have helped to reduce, to a great extent, the hazards of industrial employment . . . and that so many of its policyholders have lowered their operating expenses through the reduction in accident losses, and insurance costs.

This experience in building safety into the operations of thousands of industrial plants—an experience extending over 51 years—is at the service of *your* plant, to help you reduce costs through American Mutual's three opportunities to profit.

PROTECTION — at the Lowest Net Cost

Does Your Present Insurance Company Give You These Three Profits?

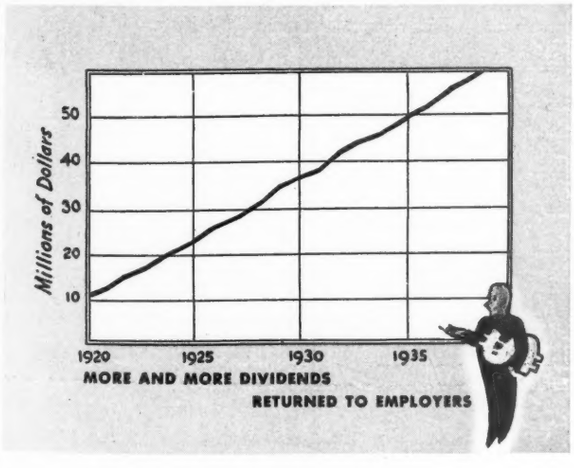
The service a compensation insurance company gives can be methodical, superficial, cut-and-dried. Or it can be understanding, constructive, invigorating. It can stop short with mechanical safety devices and automatic payment of claims . . . or it can help weld the entire organization into safety consciousness and do its utmost to make injured men *working* men again.

Safety — as American Mutual sees it — can be built economically into a plant's operating structure — increasing the working efficiency, reducing both injuries and non-injury accidents, and often lowering insurance costs.

American Mutual sees its medical service as a *rebuilding* service — restoring, when it can, to the injured man his ability to hold down his job, and to his employer the worker's valued experience.

And the result of keeping our policyholders' accident losses low—plus conservative management and investment of funds — is a cash dividend to policyholders which has always been 20% or more since 1887.

These are the things American Mutual offers you—three opportunities to profit. Have us send you a booklet describing more fully the service and profit opportunities this oldest mutual liability insurance company offers. Write 142 Berkeley St., Dept. 56, Boston, Mass., for a copy of "How Twelve Companies Saved More Than A Million Dollars".



1887

American Mutual

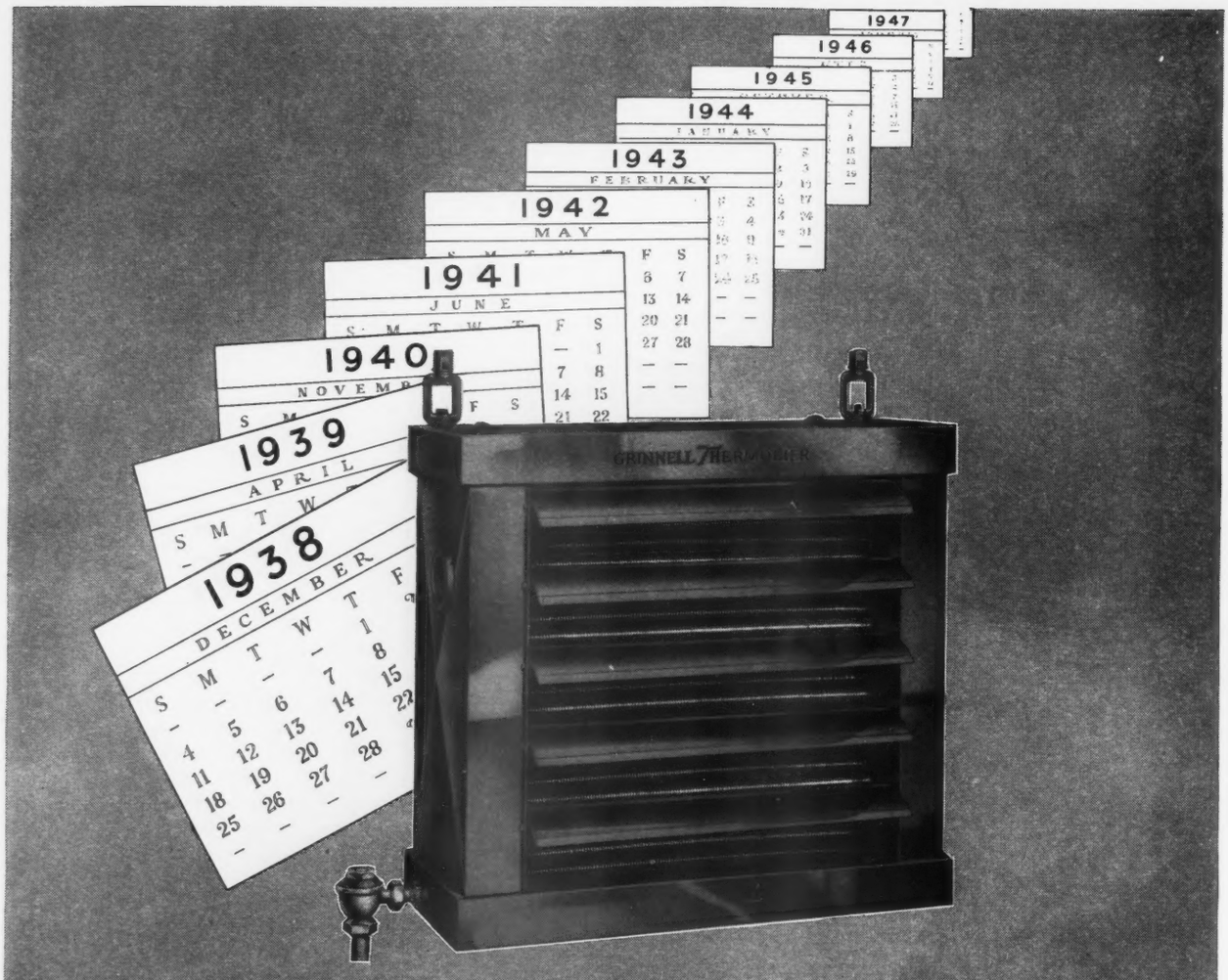
works to make all work safe

AMERICAN MUTUAL LIABILITY INSURANCE COMPANY

American Mutual has branches in 56 of the country's principal industrial centers. In addition to Workmen's Compensation, it offers opportunity for savings on Automobile, Fidelity Bond, and practically all other lines of liability insurance.

Admitted Assets: $34,866,615.84 *Liabilities:* $29,443,222.08
Surplus to Policyholders: $5,423,393.76 *As of Dec. 31, 1937*

Savings even greater than 20% have been made regularly on Fire Insurance, written by our associate, Allied American Mutual Fire Insurance Company.



BUILT FOR TOMORROW

AS WELL AS TODAY!

3 TYPES
THIRTY SIZES

To Meet Every Unit Heater Requirement

DeLuxe Type | Industrial Type | Factory Type

What are the *facts*—specific points—that give Grinnell Thermolier owners assurance that their unit heaters will operate through many "tomorrows"? First, continuous flow; no piling up of condensate, but a continuous drainage that keeps every part of the heating surface alive — that means no strains, no water hammers, no pounding. The Internal Cooling Leg does it—a feature contained exclusively in the Grinnell Thermolier. Second, unusual strength where strength is needed — in header, in copper U-tubes, and in the heat-exchanger joints where tubes and header meet. Only a manufacturer with many years of heating experience can produce a unit heater capable of lasting service . . . Grinnell engineers were known as heating specialists for a half century before unit heating was introduced. Write for the Thermolier catalog. Grinnell Company, Inc., Executive Offices, Providence, R. I., Branch offices in principal cities.

GRINNELL THERMOLIER

THE UNIT HEATER WITH 14 POINTS OF SUPERIORITY

By actual comparison...

THE SENSATIONAL NEW ALLIS-CHALMERS VARI-PITCH SPEED CHANGER

COSTS LESS TO RUN TAKES LESS SPACE IS MORE EFFICIENT

Make Your Own Comparisons ... and Be Convinced!

Compare Costs Coupled to a standard, low cost, high speed motor, the new Allis-Chalmers Vari-Pitch Speed Changer starts cutting costs right there. No need for expensive multi-speed motors or separate change-overs! And operating costs are cut. There are no springs to get out of order . . . no time-wasting steps . . . no trial-and-error guesswork! No wonder the Vari-Pitch Speed Changer costs less to run!

Compare Size Actually, the Vari-Pitch Speed Changer occupies only ¼ to ⅓ the space required by other, bulkier variable transmissions on the market today. Double shaft extensions allow the unit to be driven from either side or either end . . . by Texrope drive or by direct connection to the motor! Put the Vari-Pitch Speed Changer wherever you want it . . . there's no need for a complicated layout!

Compare Efficiency Allis-Chalmers makes no claims for efficiency for the new Vari-Pitch Speed Changer. Instead, we offer you this *fact*. The Vari-Pitch Speed Changer has attained efficiencies as high as 95% . . . efficiencies *proved* in a series of actual tests under load!

Get the whole story. Get *all* the facts. Send for Bulletin 1266. Find out how you can cut costs . . . save space . . . increase production with the new Allis-Chalmers Vari-Pitch Speed Changer. Make your own comparisons . . . *and be convinced!*

Available in sizes from 1 to 33 hp, ratios up to 3¾ to 1, maximum output speed 3500 rpm, the Vari-Pitch Speed Changer is a product of Allis-Chalmers, originators of the Texrope Drive and the Vari-Pitch Sheave.

Vari-Pitch Speed Changers • Texrope V-Belts • Duro-Brace Texsteel Sheaves • Vari-Pitch Sheaves • Standard Cast Iron Sheaves • Adjustable Pitch Diameter Texsteel Sheaves • 2-3-4 Combination Sheaves • Straitline Automatic Motor Bases • Oil Field Drilling Rigs

939

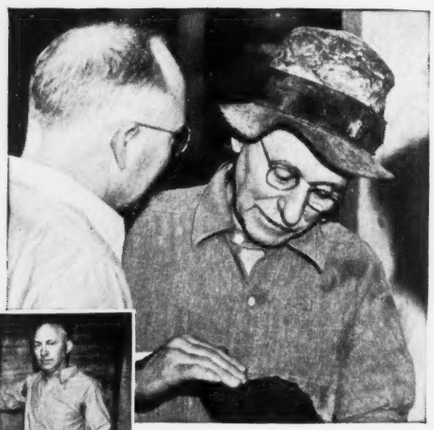
Belts by Goodrich

TEXROPE DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

FIVE MOTORS THAT COULDN'T BE DROWNED



ABOVE: Spending most of his time in the plant, J. A. Fisher keeps in close touch with production. Here he's discussing a detail with R. M. Fisher.

AT LEFT: R. M. Fisher, vice-president, Beloit Box Board Co., points out the high water mark of the recent flood. It didn't stop the Allis-Chalmers motor and pump shown here.

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

Read the Amazing True Story J. A. Fisher, president, Beloit Box Board Co., Tells about Allis-Chalmers "Lo-Maintenance" Motors! How They Were Submerged by Floods Three Times, but Gave Continuous, Trouble-Free Operation for 13 Years! Get the Story on How Allis-Chalmers Equipment Can Cut Your Costs . . . Can Pay for Itself in the Dollars It Saves!

● Three times submerged by floods . . . actually running under water . . . yet no trouble in 13 years! That's an amazing record . . . but it's true! It's the true story of the "Lo-Maintenance" Motors Allis-Chalmers sold the Beloit Box Board Co. thirteen years ago!

But let J. A. Fisher, president, Beloit Box Board Co., tell it as he did in an unsolicited letter to Allis-Chalmers.

"We aim to make a product that completely satisfies our customers," wrote Mr. Fisher. "And we expect the same from the equipment we buy.

"Thirteen years ago you sold us two motors and, shortly after, three more. Down here in Beloit, we are troubled once in a while by bad flood conditions. Since we bought them, the motors you sold us have been inundated three times — sometimes even running for hours under water.

Flood Waters Couldn't Stop Them!

"When the floods receded, all we ever did was wash the silt and dirt out of the motors and let them dry. Frankly, I'll admit we never expected them to start. But, surprisingly, once we'd throw the switch, those Allis-Chalmers motors would start out and run as well as the day we first installed them!

"For that reason we here at the Beloit Box Board Co. take considerable pride in saying that Allis-Chalmers Motors are the best, most substantial, and give less trouble in paper mill work than any other make of motor!"

Join Mr. Fisher and the thousands of other executives who benefit from the money-saving equipment . . . from the 90 years of engineering experience Allis-Chalmers can put to work for you. There's a trained production engineer in the Allis-Chalmers District Office near you. Telephone him today. Find out how you can cut production costs . . . increase earnings . . . make your plant a bigger money-maker . . . with the equipment that pays for itself!

MOTORS FOR ALL APPLICATIONS FROM ½ HORSEPOWER AND UP

ELECTRICAL DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

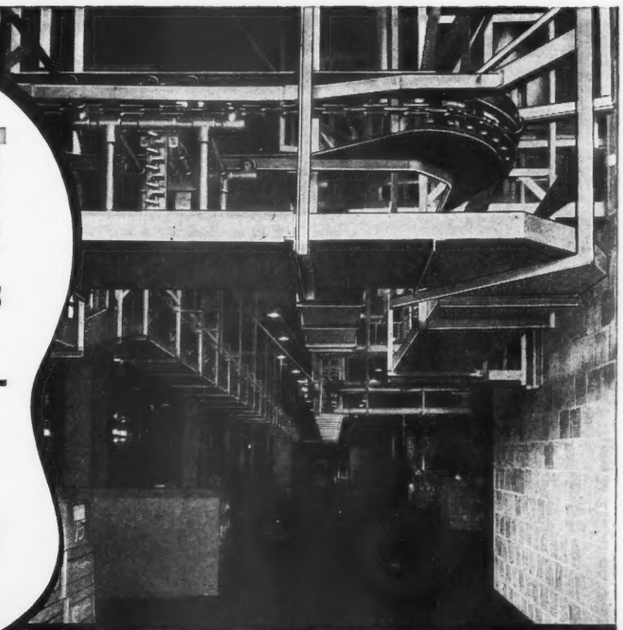
974

These

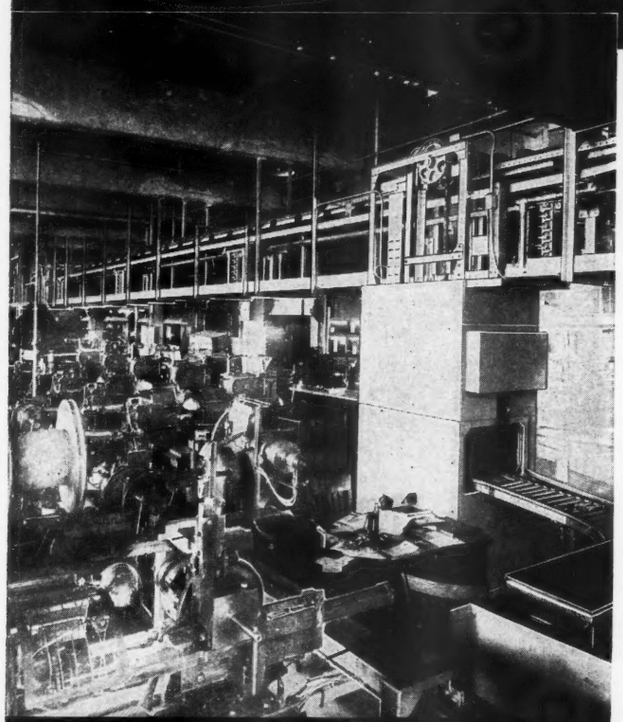
LAMSON

Overhead Conveyors

cut work-in-Process — Save Real Money in Giant Indiana Plant



Out of the way like an elevated train, these overhead Lamson Conveyors speed the flow of materials from department to department in four lengthy, adjoining buildings.

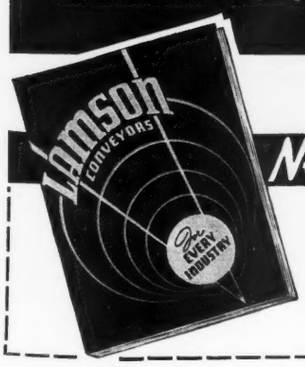


Compact vertical loading and delivery stations, as shown in the photograph above, leave practically the entire floor area for production.

EVERY day Lamson Conveyors save money in this large Indiana plant. No longer do large stocks of semi-processed parts clutter up some departments waiting to be finished. No longer is it necessary to keep men and machines waiting for materials in other departments. With Lamson Conveyors, flow of work-in-process between the departments and floors of the four big buildings of this plant is swift, smooth and uninterrupted.

Lamson engineers, in cooperation with the plant engineers, designed and built this unique type of conveyor system especially for this plant. Entirely overhead—save for vertical loading and unloading stations—it takes up little floor space. It has a selective delivery arrangement. Just push a button and it will deliver various sized tote boxes fully loaded or with only a single part to the exact station in the big plant where you want them to go.

Ask our nearest office to show you movies of the Lamson Selective Overhead Conveyors in operation in this plant. You will see—clearer than any words can tell you—the kind of expert service that Lamson engineers are prepared to render in in your plant. Check and mail the coupon.



New FREE BOOK on Cutting Production Costs

The LAMSON COMPANY, Inc.
Syracuse, N. Y.

Send me without obligation a

- ☐ Free copy of your new Conveyor booklet.
- ☐ Have your nearest Sales Engineer call and show me movies of the above conveyors.

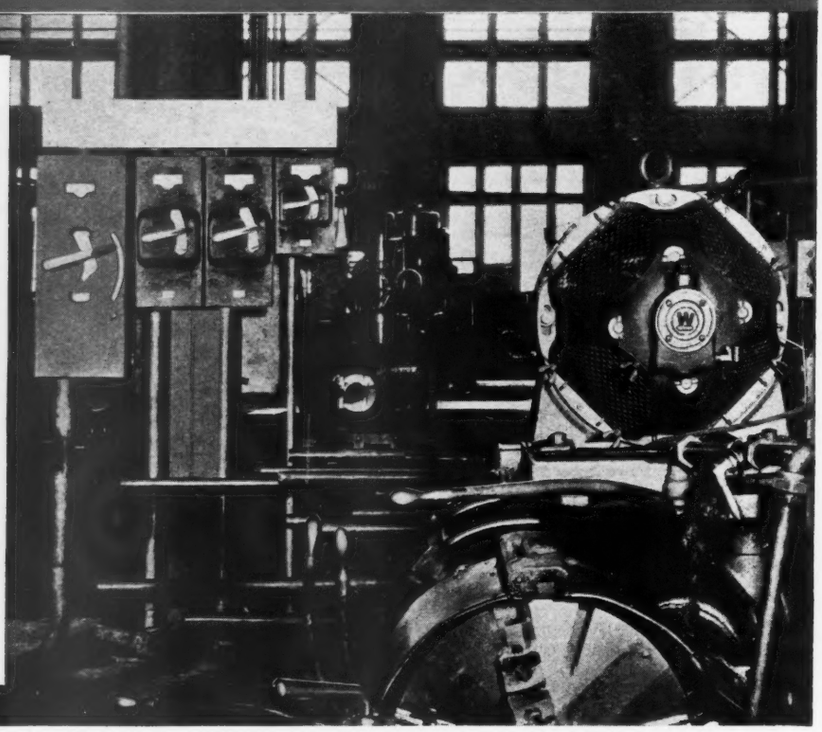
Name .....

Company .....

Address ..... *State* .....

MANY *Time-Out* LOSSES CAN BE PREVENTED by Fuseless Circuit Protection

Automatically protects circuits against severe overloads and "shorts" — without time lost by men and machines and costly fuse replacements.
Safety for circuits
Safety for workmen
Safety for machines
and SAVES many times its cost.



$400 A YEAR SAVED IN FUSE COST ALONE!

Every motor circuit in this large railroad shop is protected by Westinghouse Nofuze "De-ion" Circuit Breakers. Since the installation of fuseless circuit protection this shop is saving more than $400 a year in the cost of fuse replacements alone. And more important — many times this amount is saved because costly delays of men and machines are eliminated. Machines and men need never stand idle while a blown fuse is replaced.

You may be passing up savings such as this in your plant. Better make a note today to investigate. Call your nearest:

Electrical Wholesaler — Electrical Contractor
Industrial Agent — Motor Dealer

WESTINGHOUSE ELEC. & MFG. COMPANY
EAST PITTSBURGH, PA.

J-20529

Westinghouse *Nofuze "De-ion"* CIRCUIT BREAKERS

MOTORS • LINESTARTERS • CIRCUIT-BREAKERS • SAFETY SWITCHES • PUSH-BUTTONS

SAFEGUARD

against the ravages of

FIRE *with* R-W

Fusible link melts at 160°, doors close automatically

AUTOMATIC FIRE DOOR EQUIPMENT

THOUSANDS of plants have been saved from fire with FyeR-Wall Automatic Fire Doors, equipped with R-W Approved Hardware.

The reason is obvious.

FyeR-Wall Automatic Fire Doors are constructed of heavy corrugated galvanized sheets with thick sheet-asbestos between. No fire can pass through them!

And the doors *close themselves* at any temperature desired!

No maintenance cost whatsoever. And guaranteed for 25 years!

In addition, 15% to 25% lower insurance rates are given because of them. The label of the Underwriters' Laboratories assures this lower cost.

The R-W line also includes tinclad Fire Doors, and Flush Surface Steel Fire Doors, which are preferred under certain conditions. Approved Fire Door Hardware furnished for single and double slide and swing doors, vertical sliding doors, etc.

"R-W engineers will gladly help you solve any problem. Write for catalog No. A-66."

"Quality leaves its imprint"

Richards-Wilcox Mfg. Co.

over 50 years 1880 1937

"A HANGER FOR ANY DOOR THAT SLIDES"

AURORA, ILLINOIS, U.S.A.

Branches: New York Chicago Boston Philadelphia Cleveland Cincinnati Washington, D. C. Indianapolis St. Louis New Orleans Des Moines Minneapolis Kansas City Los Angeles San Francisco Omaha Seattle Detroit Atlanta Pittsburgh Milwaukee Richards-Wilcox Canadian Co., Ltd., London, Ont., Montreal, Winnipeg

● Riveting "dragons" in A. O. Smith Automatic Frame Plant

★How A. O. SMITH *speeded tool service and cut tool inventory, breakage and loss*

The results of their program for reducing tool service costs outlined by Mr. A. H. Beckman, Works Accountant, A. O. Smith Corporation, Milwaukee, Wis., manufacturer of pressed steel automobile frames, electric welded pressure vessels, electric welded line pipe and oil well casing, and glass-lined tanks. Speed of service: "Previous to the installation of McCaskey Tool Control in one of our fifteen cribs, a twenty-four hour time study disclosed that a tool crib transaction was completed in 1.24 minutes. Similar time studies reveal that a transaction is completed in 20 seconds in the McCaskey equipped crib. In other words, we now fill three orders per minute where formerly three brass tool check orders required approximately 3¾ minutes. The number of tools loaned at one time varies from one to twelve; the average per man is 2.1 tools *per trip.*"

Space limitations prevent an account of how these savings, direct and indirect, were accomplished. The methods are described in detail by Mr. Beckman in an article entitled "A Modern Tool Control System in a Modern Plant" reprinted from Modern Machine Shop. Write for a copy today or for pamphlets describing other McCaskey Controls.

★*Additional Economies Effected Include:*

Physical Inventory: "The time required for our annual physical inventory has been reduced from 338 man hours to 104 man hours."

Inventory Reduction: "Four cuts in two years, totalling approximately $9,000.... The close check on tools seems to aid in drawing out of their hiding places tools of which all trace had been lost."

Breakage Reduction: "From $90 to $40 per month."

Lost, Strayed, or Stolen: "Under the old system this amounted to a considerable sum each year. Under the present system the loss of a tool is very rare indeed."

Tool Inspection: "An accumulation of damaged and dull tools in the bins is avoided and the entire stock of tools can be kept in readiness for use."

Workmen's Attitude: "The arguments that wasted time and ruined otherwise good dispositions in the days of yore have been completely eliminated. The workmen would rebel at once if an attempt were made to revert to the old method."

Attendant's Attitude: "The accuracy and speed of the system reduces the amount of work required of the attendant."

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

BULL DOG

Trol-E-Duct

UNIVERSAL TYPE

A NEW WIRING SYSTEM

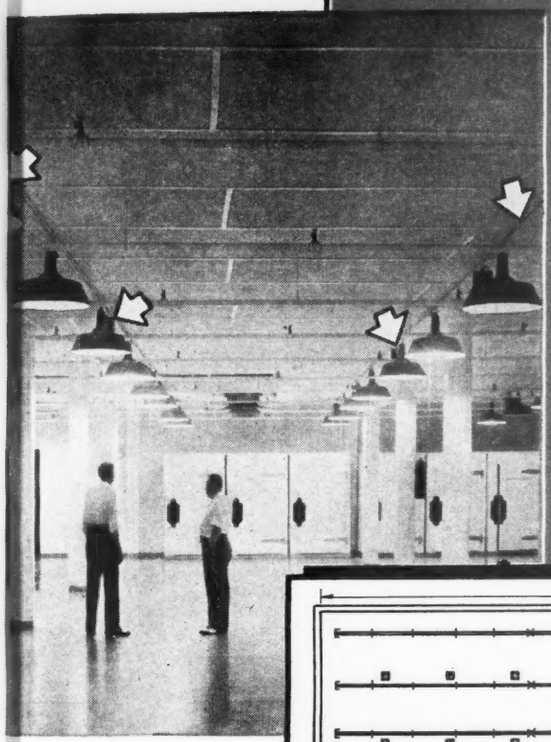
Distinguished By

LESS VOLTAGE LOSS *Plus* MORE FLEXIBILITY

Trol-E-Duct—a Busway Wiring System with fixed size 50 Amp. Bus Conductors—permits use of large capacity circuits in lieu of several small ones. This reduces voltage loss and effects greater efficiency and economy in current consumption.

Movable Trolley Collectors or Semi-fixed Twistout Plugs, inserted at any point in the slotted Duct, provide *flexible* Light and Power Outlets where and when desired.

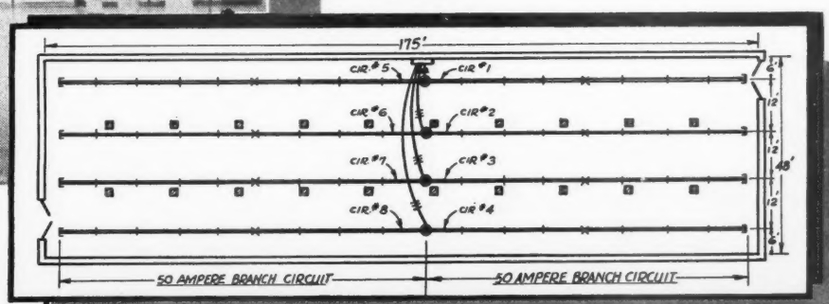
A complete assortment of Fittings makes possible a Wiring System to fit the layout of any building and the initial installation or later changes or additions can be more quickly and economically made than with old type, conventional Wiring Systems.



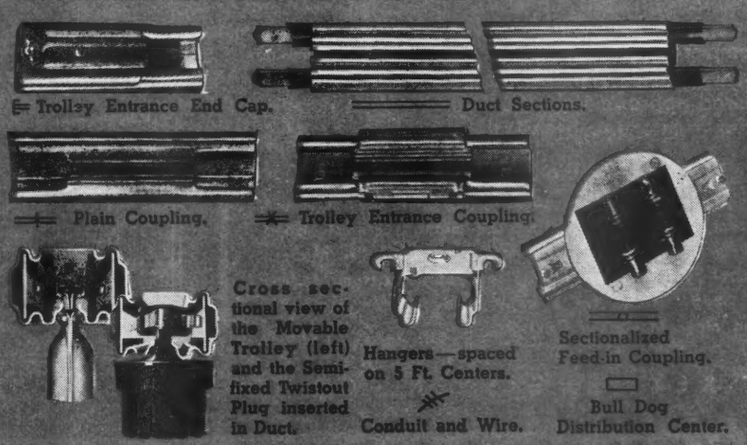
In this air conditioned manufacturing Department, devoted to precision work and solely dependent on artificial lighting, four runs of Universal *Trol-E-Duct* support and feed 30 400 Watt high intensity Mercury Vapor Lamps and 30 750 Watt Mazda Lamps, alternately spaced.

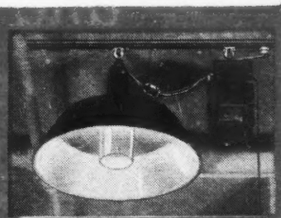
The Lamps are suspended from the Duct by Bull Dog heavy duty weight supports. Tap-offs from the Duct to the Lamps are Terminal Type Twistout Plugs.

Universal *Trol-E-Duct* was chosen as the Wiring System because of: (1) The ease and quickness of installation. (2) The fixed size of its ample conductors which reduces voltage loss with consequent greater efficiency in illumination and economy of current and (3) its flexibility for future changes or additions.

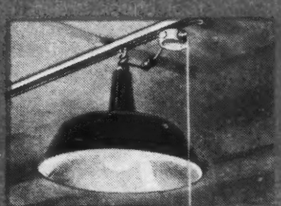


INSTALLATION WIRING DIAGRAM AND SYMBOLIZED TROL-E-DUCT UNITS


Trolley Entrance End Cap.
Duct Sections.
Plain Coupling.
Trolley Entrance Coupling.
Cross sectional view of the Movable Trolley (left) and the Semi-fixed Twistout Plug inserted in Duct.
Hangers—spaced on 5 Ft. Centers.
Conduit and Wire.
Sectionalized Feed-in Coupling.
Bull Dog Distribution Center.



Close-up of the 400 Watt, high intensity, *Mercury Vapor Lamp* suspended from the *Trol-E-Duct* and electrically connected thereto through Lamp Auto-Transformer and Terminal Type *Twistout Plug*.



Close-up of the 750 Watt *Mazda Lighting Unit* suspended from the *Trol-E-Duct* and electrically connected thereto through outlet box and Terminal Type *Twistout Plug*.

ADEQUATE WIRING SERVES AND SAVES

Write for pocket size booklet: "How to mobilize lighting and power units with TROL-E-DUCT."

BULL DOG ELECTRIC PRODUCTS COMPANY

Pioneers In Flexible Electrical Distribution Systems

DETROIT, MICHIGAN

BULL DOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO, ONT.

Manufacturers of *Vacu-Break* SAFETY SWITCHES, PANELBOARDS, SWITCHBOARDS, DUCT SYSTEMS

ROCKBESTOS *does away with "Maintenance"*

Whether you are most anxious to save time or money doesn't matter if you use Rockbestos in your wire-wrecking circuits, because you save both. No need for continually sitting on the lid of heat-dried trouble-making runs waiting for them to pop. No need for repeated rewiring and expensive installation. As the chief electrician of a shipbuilding plant puts it: "No periodic replacement just when attention is needed elsewhere" . . . or as another says: "I use Rockbestos in heat, oil and dampness and forget it."

You, too, can forget your circuits if they are wired with Rockbestos asbestos insulated wire because it's heatproof, fireproof, vibrationproof, and resistant to oil, grease and corrosive fumes. Send for samples and a catalog. Rockbestos Products Corporation, 899 Nicoll Street, New Haven, Conn.

Also refer to Electrical World Buyer's Reference Number of 1938.

ADEQUATE WIRING SERVES AND SAVES

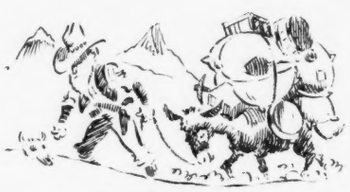
OTHER ROCKBESTOS FEATURES

IT IS VIBRATION-PROOF

Rockbestos insulation won't dry out, crack, open up, or fall off.

IT WILL NOT BLOOM

Rockbestos won't rot, bloom or swell under action of oil, grease or fumes.



IT HAS GREATER CARRYING CAPACITY

Rockbestos' greater carrying capacity saves conduit replacement, labor and money.

IT IS HEATPROOF

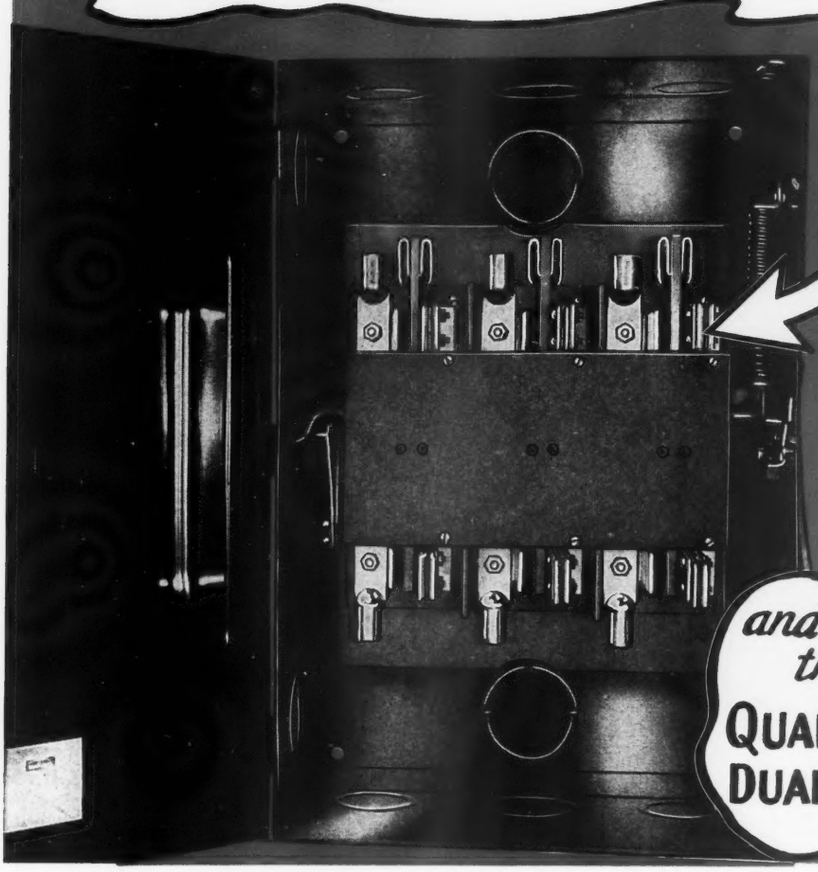
Rockbestos insulation, made of asbestos, does not deteriorate under heat. It's flame-proof, too.

IT IS PERMANENT

Rockbestos is always "as good as new" because asbestos is naturally time resistant.

ROCKBESTOS A.V.C.—the wire with permanent insulation

BIG SWITCH *Efficiency* *begins* ***RIGHT HERE***



The unit shown at the left is Catalog Number 75934, 400 amperes, 3 pole. Equipped with flat Pistol Grip Operating Handle. Takes up minimum space. . . standard equipment on all Heavy Duty Quadbreak and Dualbreak switches.

and the bigger the switch the more it needs
QUADBREAK *and*
DUALBREAK *mechanism!*

Brute strength alone isn't enough in a Safety Switch . . . particularly in a high capacity, heavy duty unit. What really counts is the mechanical design. That's why Colt-Noark Heavy Duty Switches have proved so popular for industrial service where the going is tough. The QUADBREAK and DUALBREAK Mechanisms have been designed with features that really stand for efficient operation . . . long life . . . and absolute safety. Their rugged, roomy cabinets are important . . . but real efficiency begins in the switching mechanism itself. That's why you can sell and install these switches with perfect confidence in their ability to deliver satisfaction. They are available in capacities up to and including 1200 amperes.

QUADBREAK . . . in the 575 Volt Quadbreak Safety Switches, the current is ruptured at four distinct points in each leg. This means less arc . . . a bare minimum of it. And that in turn means longer life, greater safety.

DUALBREAK . . . in the 250 Volt Dualbreak Safety Switches, the current is ruptured twice in each leg. Both Quadbreak and Dualbreak units have Quick-Make and Quick-Break, and Interlocking Covers.

Pacific Coast Representative, The Frank H. Bran Company, San Francisco and Los Angeles

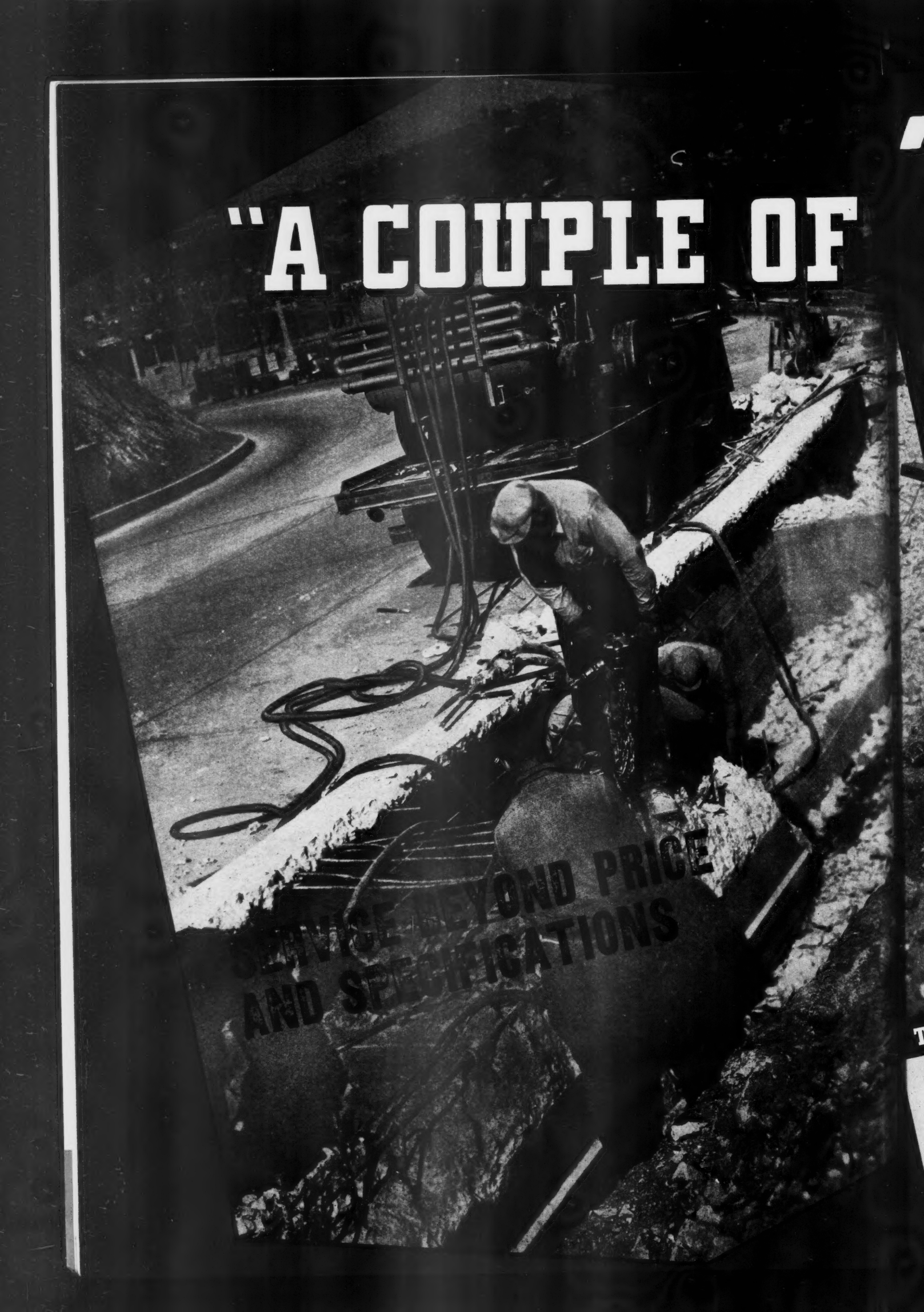
COLT'S PATENT FIRE ARMS MFG. CO., Electrical Division HARTFORD, CONN.

100 Years of Manufacturing Experience is back of every Colt Built Product

COLT-NOARK

SWITCHES INDUSTRIAL CONTROL EQUIPMENT FUSES

Boston
New York
Chicago
Philadelphia


"A COUPLE OF
AND SPECIFICATIONS

'Toughies' THAT HANDLE EASY"

BUILT LIKE TIRES...TO TAKE PUNISHMENT LIKE TIRES...U. S. SUPER ROYAL AND U. S. ROYAL CORD AIR HOSE RESIST OIL...IMPACT ...ABRASION...PRESSURE...ARE MORE FLEXIBLE...LIVE LONGER!

Up in the front line trenches of industry where grit bites and grinds... and sharp rock cuts... where falling stone and careless wheels bruise and crush... you'll find U. S. *Super* Royal Cord Air Hose and U. S. Royal Cord Air Hose doing a job... giving Service Beyond Price and Specifications!

Tough as truck tires—because of super quality multiple ply construction—highly flexible because of special U. S. carcass construction... U. S. Air Hose always handles easily! When you've got a job that's a "hose-killer," call in U. S. *Super* or U. S. Royal Cord Air Hose...they'll "mop-up" where others quit!

UNITED STATES RUBBER COMPANY · US · TRADE MARK

United States Rubber Company

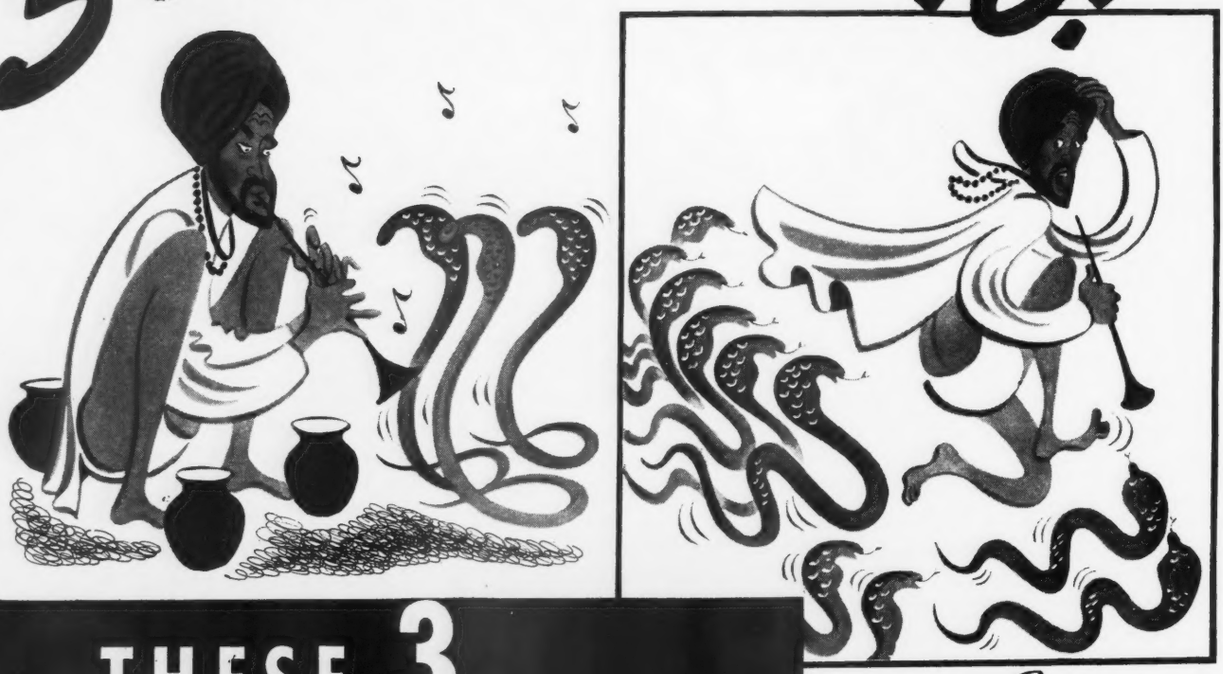
United States Rubber Products, Inc., New York, N. Y.

THEY FINISH WHERE THEY START...ON THE JOB!

U. S. SUPER ROYAL CORD AIR HOSE 1. Resists oil with specially compounded rubber tube. 2. Prevents shearing action between plies because each strand of cotton cord is laid in a separate rubber cushion. 3. Resists external blows or bruises because of unique carcass construction. 4. Resists greater pressures than conventional-type hose. 5. Is extremely flexible and easy to handle. 6. Withstands maximum abrasion because of extra tough, non-peeling cover.

U. S. ROYAL CORD AIR HOSE is light in weight, flexible, tough and oil-resistant because: 1. It has an oil-resistant tube of specially compounded rubber. 2. Tube is anchored by a breaker-ply to two specially laid cord plies cushioned in rubber. 3. Special tire-like cord carcass construction protected by rubber cushions prevents shearing action. 4. It has the toughest abrasive-resistant rubber cover ever put on a molded hose!

3 are easier than 10!



THESE 3 EAGLE BEARING METALS

. . . meet most bearing metal requirements

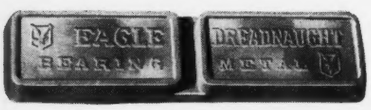
You take no chances when you rely on

EAGLE *Controlled Specifications*

● Trouble-free operation is assured — costly shutdowns are minimized — when you specify Eagle Bearing Metals. These metals are alloyed under strict pyrometric control — and only of clean, primary metals. This rigid practice guarantees uniformity and long life. Eagle Bearing Metals contain no hard spots to cut and score the shaft. Ordinary bearing metal troubles are ended.

Controlled Specifications

GUARANTEE UNIFORMITY



EAGLE DREADNAUGHT

For extreme speed and pressure conditions

EAGLE OUTLASTA

For medium speed and pressure conditions

EAGLE DURABLE

For low speed and pressure conditions

EAGLE PICHER

EAGLE BEARING METALS ARE SOLD THROUGH RECOGNIZED DISTRIBUTORS

THE EAGLE-PICHER LEAD COMPANY • CHICAGO • JOPLIN • CINCINNATI

THERE'S A SWITCH WE NEVER HAVE TO BOTHER WITH, JOE!
YOU SAID IT BOSS! THESE WESTINGHOUSE SAFETY SWITCHES SURE STAND UP AND TAKE IT. YOU DONT HAVE TO NURSE THEM ALONG

The exclusive Westinghouse Diamond pointed jaw confines the bead to sections outside the contact area, sections which do not normally carry current.

TIGHT, COOL CONTACTS IN THESE SAFETY SWITCHES

You don't have to keep dressing down jaws and blades to maintain tight, cool contacts in Westinghouse Safety Switches. Jaws are diamond-shaped. When contact is broken, the arc is drawn between the diamond point of the break jaw and the *end* of the blade. The sections that carry current cannot pit, bead or burn off.

In addition, one-piece copper parts prevent heating from loose connections. And in 575 and 600-volt switches, "De-ion" grids quench heavy arcs almost instantly.

For safe contact at all times, specify Westinghouse. All commercial types and ratings available from your:

Electrical Wholesaler — Electrical Contractor
Motor Dealer — Industrial Agent

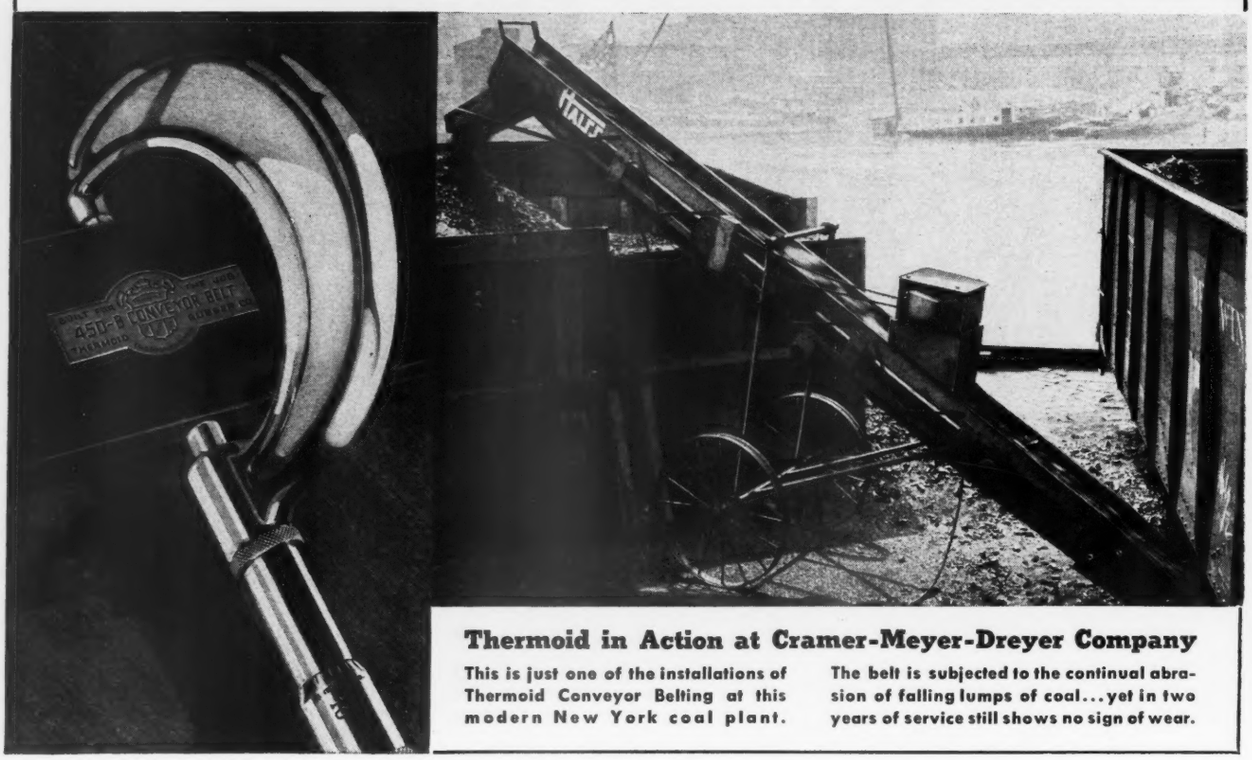
WESTINGHOUSE ELECTRIC & MANUFACTURING CO., EAST PITTSBURGH, PA.

J-20516

Westinghouse *Safety Switches*

MOTORS • CONTROL • CIRCUIT BREAKERS • SAFETY SWITCHES • PUSH BUTTONS

Thermoid gives micrometer accuracy to CONVEYOR BELTING



Thermoid in Action at Cramer-Meyer-Dreyer Company

This is just one of the installations of Thermoid Conveyor Belting at this modern New York coal plant. The belt is subjected to the continual abrasion of falling lumps of coal... yet in two years of service still shows no sign of wear.

More than half a century of Progressive Engineering and Product Development

The unique construction of Thermoid Conveyor Belting contributes many advantages not found in other belting. Its edges are absolutely parallel. Cutting and accurate joining are never problems when using Thermoid belting.

Straight laid plies not only assure this constant width, but provide a uniform cover thickness which guarantees long life and uninterrupted service.

There's a Thermoid Conveyor Belting engineered for longest life in each particular type of service. When you specify Thermoid you can be sure of getting the *right* belt for the *right* job.

On new installations, or on replacements, specify Thermoid for real economy and operating efficiency.

Standard types of belting made by Thermoid:
Conveyor Belting
Transmission Belting
Multiple-V Belts
Grader Belting
Canners' Belting
Bucket Elevator Belting

Thermoid

Standard types of belting made by Thermoid:
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Agricultural Belting
Hog Scraper Belting
Endless Thresher Belting
Oil Country Belting
Axle Lighting Belting

THERMOID RUBBER, DIVISION OF THERMOID COMPANY, TRENTON, N. J.

HAVE YOU A GOLD MINE IN THIS FILE, TOO?

Read how an analysis of your damage claims may both save and make you money

Your most costly shipping casualties are the ones you rarely hear about . . . the kind that just annoy your customers but do not justify filing damage claims. It often takes but a few of these to turn a good customer into a good prospect for your competitor.

But though you never hear about these costly damages, an analysis of the claims you *do* pay will help you prevent them. For when you group the causes of damage claims, you'll usually find many of them could be overcome by safer shipping containers. And cutting down the number of known shipping casualties will wipe out a multitude of those costly, unknown damages as well.

Gaylord packaging specialists have proved this fact time and again. Customers are quick to react to safer arrival of their orders . . . sales respond accordingly . . . salesmen display more enthusiasm . . . new business is easier to secure and hold . . . and sales and delivery costs go down.

Why not make a study of your damage claim file? It may prove a veritable gold mine for you, too. Then, let the Gaylord staff of packaging specialists design containers to meet the specific needs of your shipments. If you wish, we'll gladly cooperate with you in making your analysis. Just phone or write our nearest office.

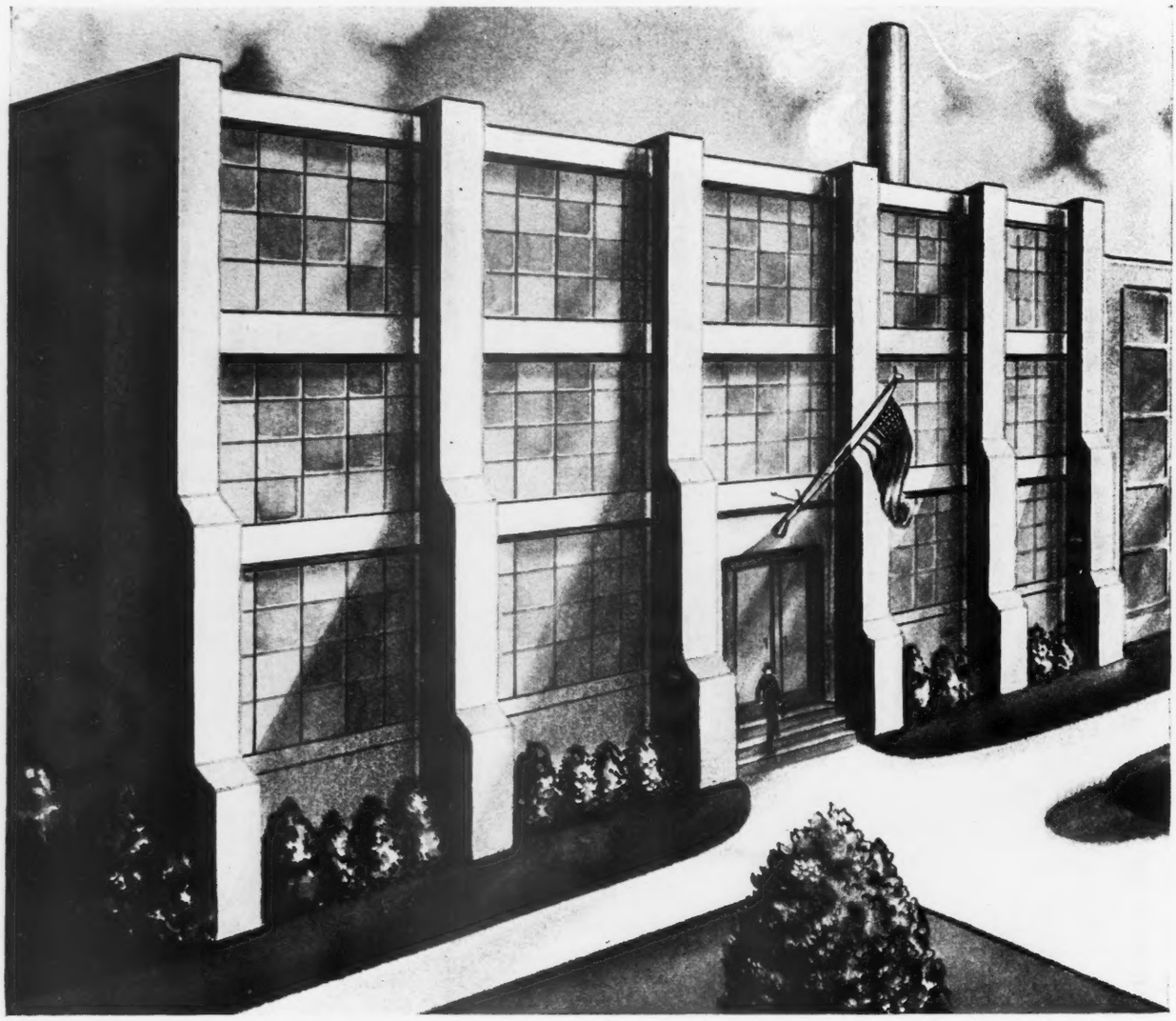
Gaylord Boxes

Corrugated and solid fibre shipping containers

It will also pay you to investigate:
GAYLORD FOLDING CARTONS
PAPER BAGS • WRAPPING PAPER
and KRAFT SPECIALTIES

GAYLORD CONTAINER CORPORATION, General Offices: Saint Louis

There's a Gaylord plant or sales office in your territory



The *Expense* of Hardwood Floors *Saved* By Unisorb Installation.

A LARGE company had built a number of small self-contained mills throughout the South. Desiring to take advantage of modern concrete construction the mills had concrete floors, upon which their machines would have wracked to pieces unless a wooden floor was installed on top of the concrete. Felters engineers were called in in an effort to see if Felters Unisorb pads could be placed under machine feet in order to save the expense of laying hardwood floors. Our engineers found that the hardwood floors could be eliminated by the use of Unisorb pads at a tremendous saving and that additional savings could be made in the actual labor involved in setting the machinery in place, as the Unisorb pads do not require holding-down-bolts. After the felt was installed, the company found that not only had they effectively eliminated hardwood floors but also that they gained in the reduction of transmitted vibration and in the sound reducing properties of the Unisorb.

Our engineers are working in our research laboratory every day on problems such as this. Unisorb has found a definite place in the industrial life of the nation and new uses and new applications are being made all the time.

We have published an interesting booklet on Vibration Control. We should be happy to send you this booklet free of charge upon application on your company letterhead.

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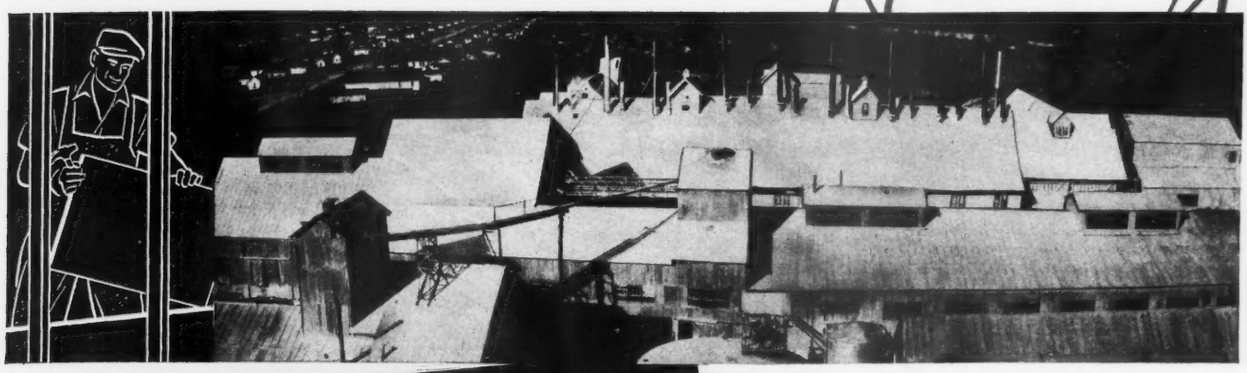
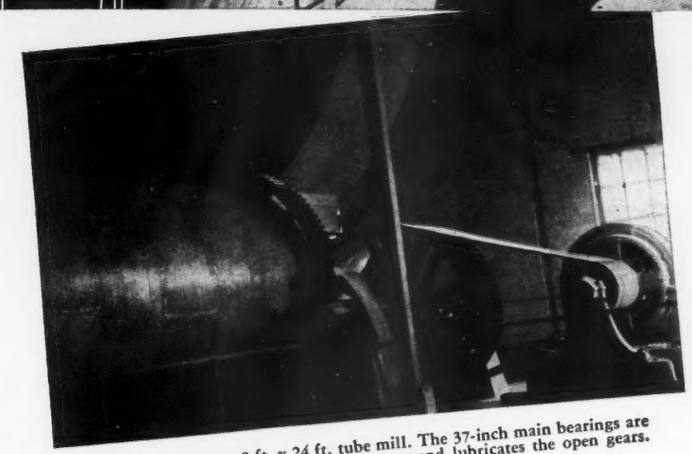
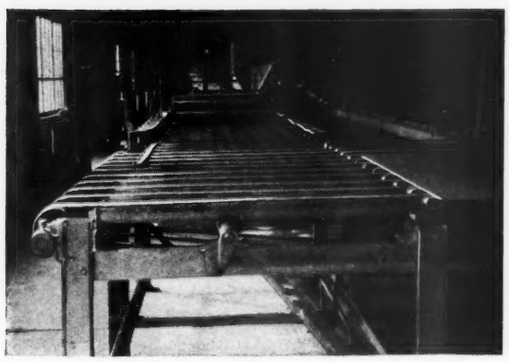
BIG GYPSUM PLANT KNOWS *how to handle heat!*



Gypsum wallboard plant of Texas Cement Plaster Co., with employees' cottages in background.



(Above) Patterson 8 ft. x 24 ft. tube mill. The 37-inch main bearings are Texaco lubricated. Texaco Crater Compound lubricates the open gears.



(Left) Part of plant where finished gypsum wallboard is cut and sent to ovens for final drying.

THE GYPSUM WALLBOARD, lath, and plaster products of The Texas Cement Plaster Company, Hamlin, Texas, are made to resist the heat of combustion.

The plant, where these products are made, is equally on guard against *frictional* heat . . . it is lubricated throughout with Texaco Industrial Lubricants.

On the tube mill journals carrying material at 300° F., a tough place for any lubricant, on the heavy gears, the electric motors, and other mill machinery, Texaco Lubricants are giving excellent service, keeping wear to the very minimum.

Trained lubrication engineers will be glad to help you make a sound selection of Texaco Lubricants for the specific conditions in your plant.

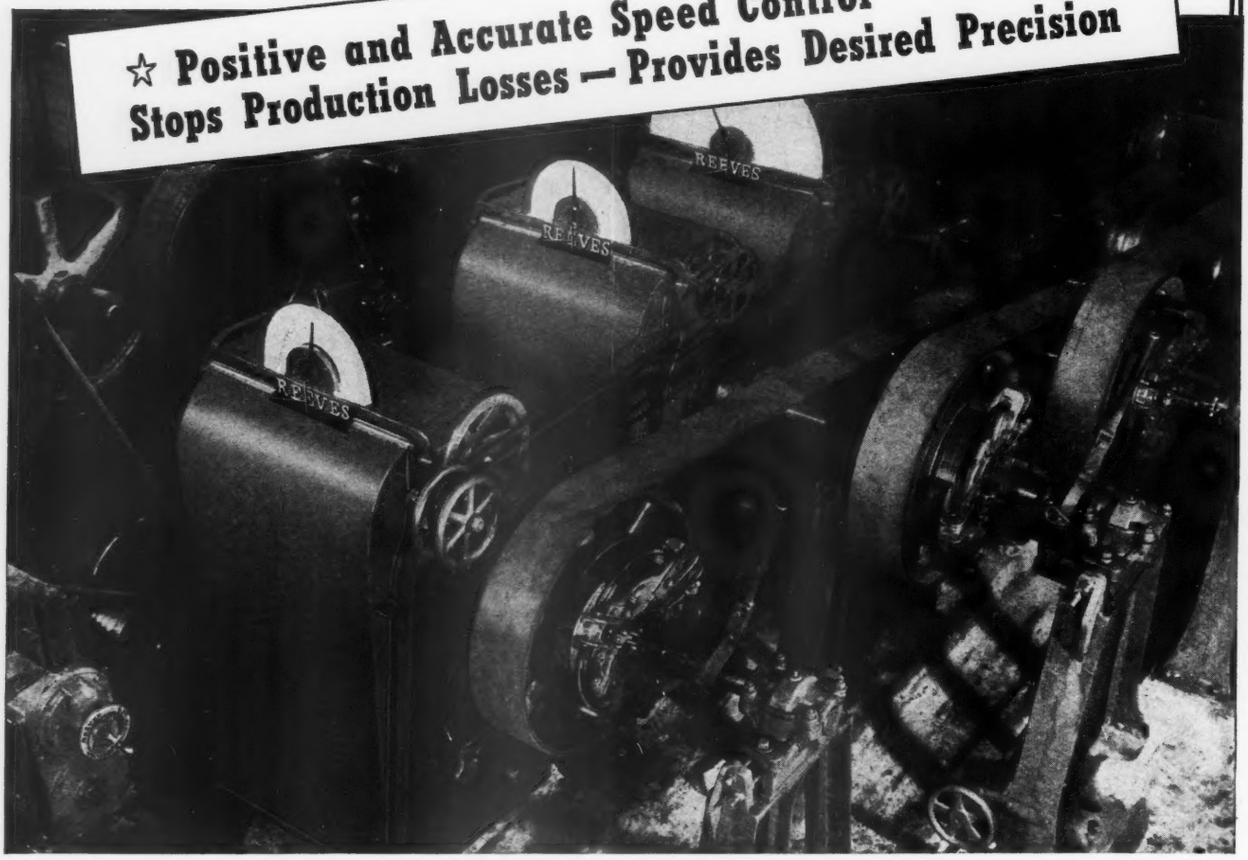
2186 Texaco warehouses assure prompt deliveries. Phone or write the nearest plant, or,

The Texas Company, 135 East 42nd Street, New York City.

TEXACO *INDUSTRIAL LUBRICANTS*

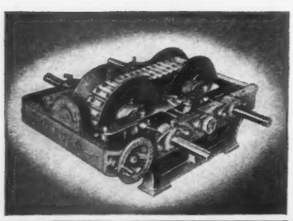
WHEN "*A MISS IS AS* BAD *AS A MILE*"...

☆ Positive and Accurate Speed Control Stops Production Losses — Provides Desired Precision

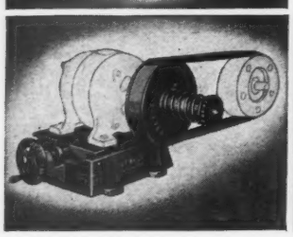


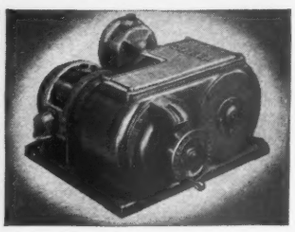
● In the operation of many machines, speed variation is not only essential, but it must be *absolutely accurate*—otherwise materials are wasted, quality or quantity of production lost, additional operations made necessary.

On such work, it is literally true that "a miss is as bad as a mile." Even *slight* slippage or fluctuation in speed is costly.



In operating the paper board cutter shown above, at Mac Sim Bar Paper Co., Otsego, Mich., greater accuracy was required in cutting dimensions of sheets. On the longest lengths, it was impossible to hold the sheet within ¾-inch plus or minus of the required length. This called for an extra trimming operation on a press cutter. Three REEVES Variable Speed Transmissions were then installed to drive the three fly-knives and draw rolls; also a REEVES Motodrive to drive the carrier roll.





Now, sheet length is held within 1/16-inch plus or minus of desired length, waste of paper in the press cutter is eliminated and this extra operation is saved.

Because nearly every application of REEVES Speed Control presents a different set of conditions—impractical to overcome with one type of control—REEVES builds *three basic units* in a wide range of sizes, designs, ratios and controls. REEVES sales representatives are trained speed control engineers, and are located in all important industrial centers. May they help you choose and apply speed control that will meet your individual requirements correctly? Write for new Catalog G-374 just off the press.

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Reeves Speed Control

BETTER THAN EVER!

★ The New 1939

"Buffalo"

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. . . .High efficiency, extremely quiet fan.

. . . .Heater elements of one-piece lightweight copper fin coil—non-corrosive, suitable for either low or high steam pressures.

. . . .Easily installed.

. . . .Wide range of sizes.

The Unit Heater that keeps the whole room or area at the *right* working temperature.

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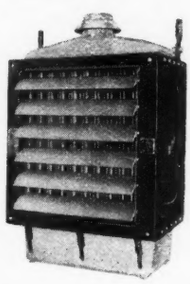
In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

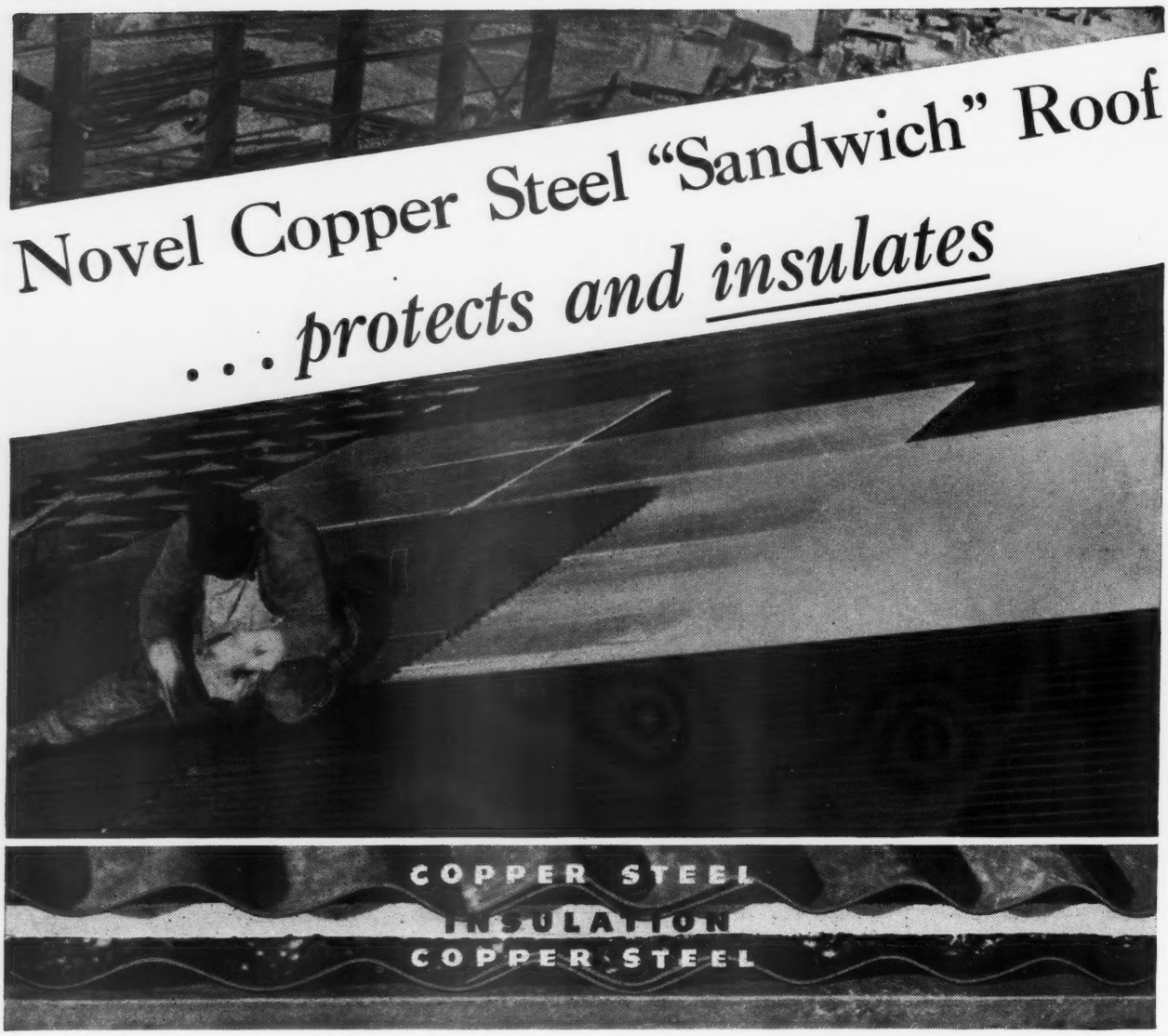


OTHER BUFFALO UNIT HEATERS

GAS—Buffalo Gas Unit Heaters burn either natural or artificial gas. Their attractive design permits their use in factory, store or office. Equipped with every necessary safety device. Fully described in our Bulletin 2852.

LARGER HEATERS—For heating large factory areas, we recommend our Highboy and Lowboy Unit Heaters. May be placed on the floor or suspended from the ceiling. The several outlets permit distribution of warm air in several directions. Full details on request. Write for Bulletin 3050.

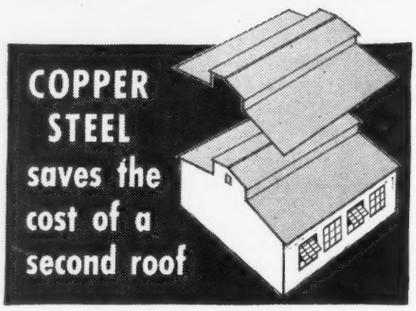
Novel Copper Steel "Sandwich" Roof ... *protects and insulates*



WARMER in winter, cooler in summer and weather-proof all year around—these are a few advantages of the unusual roof designed for a new Pittsburgh steel mill. It is built like a sandwich with insulating material clamped between two layers of U·S·S Corrugated Copper Steel. The new roof has double strength and is expected to last two to four times as long as a conventional steel roof.

Copper Steel was used because it combines low cost with higher corrosion resistance. For industrial roofing, Copper Steel has proved its superiority and economy over long periods.

If you are planning a new roof, we will be glad to furnish information about the various materials available and the advantages of each. Write to our nearest district office or to one of the companies listed below.



HUNDREDS OF installations and numerous tests show conclusively that U·S·S Copper Steel lasts from two to three times as long as plain steel. It actually saves you the cost of buying and installing your second roof.

U·S·S COPPER STEEL GALVANIZED SHEETS

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COLUMBIA STEEL COMPANY, *San Francisco*
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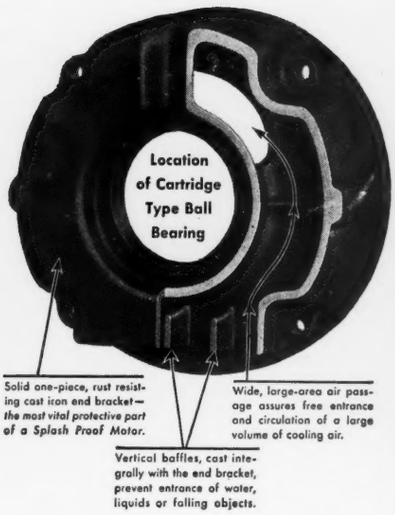
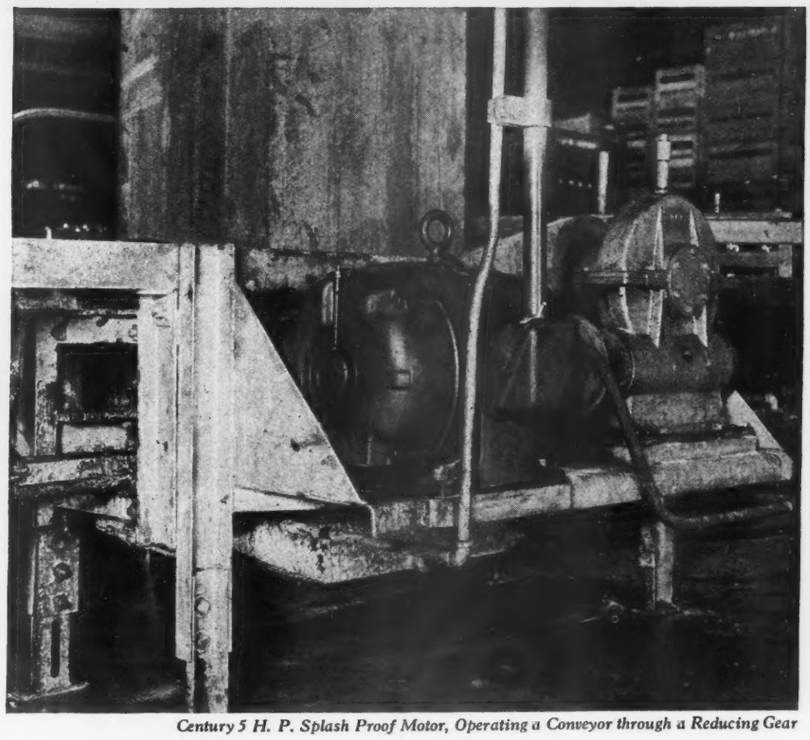
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Where There's Splashing Water—Get Low-Cost Insurance Against Production Interruptions . . . Use Century Splash-Proof Motors


Location of Cartridge Type Ball Bearing
Solid one-piece, rust resisting cast iron end bracket—*the most vital protective part of a Splash Proof Motor.*
Wide, large-area air passage assures free entrance and circulation of a large volume of cooling air.
Vertical baffles, cast integrally with the end bracket, prevent entrance of water, liquids or falling objects.



Century 5 H. P. Splash Proof Motor, Operating a Conveyor through a Reducing Gear

Water Can't Enter and DAMAGE THE WINDINGS

There are a lot of places in the Chemical and Process Industries where a motor is likely to be damaged internally because it must operate in splashing surroundings.

On such jobs, Century Splash Proof Motors will give you low-cost insurance against production interruptions—because water can't enter the motor and damage the windings.

The cross section of the end bracket shows how this extra protection is provided against dripping and splashing liquids. . . . Also, where motors and machinery are given a daily, and often hourly, washing down.

This safe protection assures longer motor service—keeps production up—saves costly repairs—avoids shutdowns and delays. . . . That's why so many of the biggest companies in the Processing Field use Century Splash Proof Motors.

Why don't you arrange now to get these benefits that thousands of industrial users are getting. Ask for application data.

NEMA Rule MG50-16, SPLASH-PROOF MACHINE (New), Adopted Standard 8/1/35, reads:
"A splash-proof machine is one in which the ventilating openings are so constructed that drops of liquid or solid particles falling on the machine or coming towards it in a straight line, at any angle not greater than 100 deg. from the vertical, connot enter the machine either directly or by striking and running along a surface."

Century MOTORS

CENTURY ELECTRIC COMPANY
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ONE OF THE LARGEST EXCLUSIVE MOTOR MANUFACTURERS IN THE WORLD

HERE'S ONE ECONOMY THAT'S *POPULAR* WITH *ALL* EMPLOYEES

How a "Washroom Tour" can help you build Good Will —save you money

SEVERAL TIMES every day your employees visit the washroom. No other one place in your plant or office can be used so effectively and economically to build employee good will.

Perhaps a "washroom tour" would open your eyes... save you money. For it's truly amazing how waste and extra expense are cut down by proper washroom planning . . . how good will can be created by providing such conveniences as hot water, soap and plenty of clean, *individual* ScotTissue Towels.

ScotTissue Towels are specially processed to make them pliant, cloth-like and absorbent. One dries drier than several ordinary paper towels . . . that's why they go farther . . . cost you less per year. By installing ScotTissue Towels you'll positively cut expenses. In addition, you'll provide a service for your employees vital in health protection.

EXECUTIVES **wishing to improve washroom conditions in their plants or offices will be interested in the Scott Washroom Advisory Service. At your request a Scott Washroom Engineer will make a scientific survey of your washroom facilities without obligation to you. He will suggest how your washrooms can be economically and efficiently arranged to relieve congestion, reduce waste and overhead expense, and create good will among your employees. Scott Paper Company, Chester, Pa.**

Thirsty Fibre Really **DRIES**

ScotTissue Towels

Trade Mark Reg. U. S. Pat. Off.

BY THE MAKERS OF SCOTTISSUE, WALDORF AND SCOTTOWELS FOR HOMES

Contents

Factory
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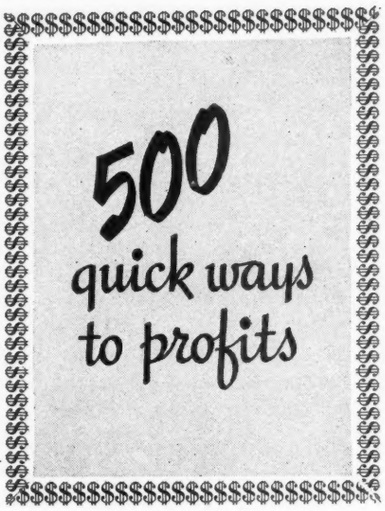

COMING—*in November*—a whole issue full of cost-cutting ideas sent in by readers and manufacturers, or gathered from the far corners of industry by the editors in their travels. This unique service is timed to meet the upward swing of the pendulum when management is traditionally willing to approve moderate expenditures for cost reduction and modernization, especially those that promise quick returns. The 53 winners of the Factory Awards will also be named in this unusual issue.

Management Accepts Responsibilities.....*an editorial* 43
Handling in Ford's New Tire Plant...*Arthur Van Vlissingen* 44
A Balcony for Storage.....*an operating short* 48
Quick Deliveries, Because—.....*W. C. Zinck* 49
Bee-Line Flow with Room to Grow.....*L. K. Urquhart* 52
Small Plant Adapts Big-Plant Cost Method.*F. K. Zimmerman* 54
Save Typist's Time and Effort.....*an operating short* 55
Management's Aims and Responsibilities....*Lewis H. Brown* 56
Social and Economic Aspects of Management..... 58
Public Relations for Industry..*a special editorial service* 61 to 76

- Industry's Major Problem..... 62
- Why a Public Relations Program..... 63
- A Program for Industrial Relations..... 67
- How a Company Can Make Simple Reports to Its Employees. 72
- How Much Income Factories Received..... 73
- What Factories Spent Their Income For..... 74
- How Much Employees, Management, and Owners Got..... 75
- Combined Operating Statement, 1929-1935..... 76
- Operating Statement by Years, 1929-1935..... 76

Lubrication on Incentive.....*George L. Dirks* 77
Relays Keep Production Up.....*Gilbert Lindgren* 80
Phone Systems Within the Plant.....*Frederick Smith* 82
When Connecting Motor and Load.....*R. F. Emerson* 84
Data Sheets—Time Values for Arc Welding..*H. F. Jacobsen* 87

You Want to Know..... 92
What's New in Equipment.... 94
Operating Shorts 104
Trade Literature 142
Books 146
On the Calendar..... 148

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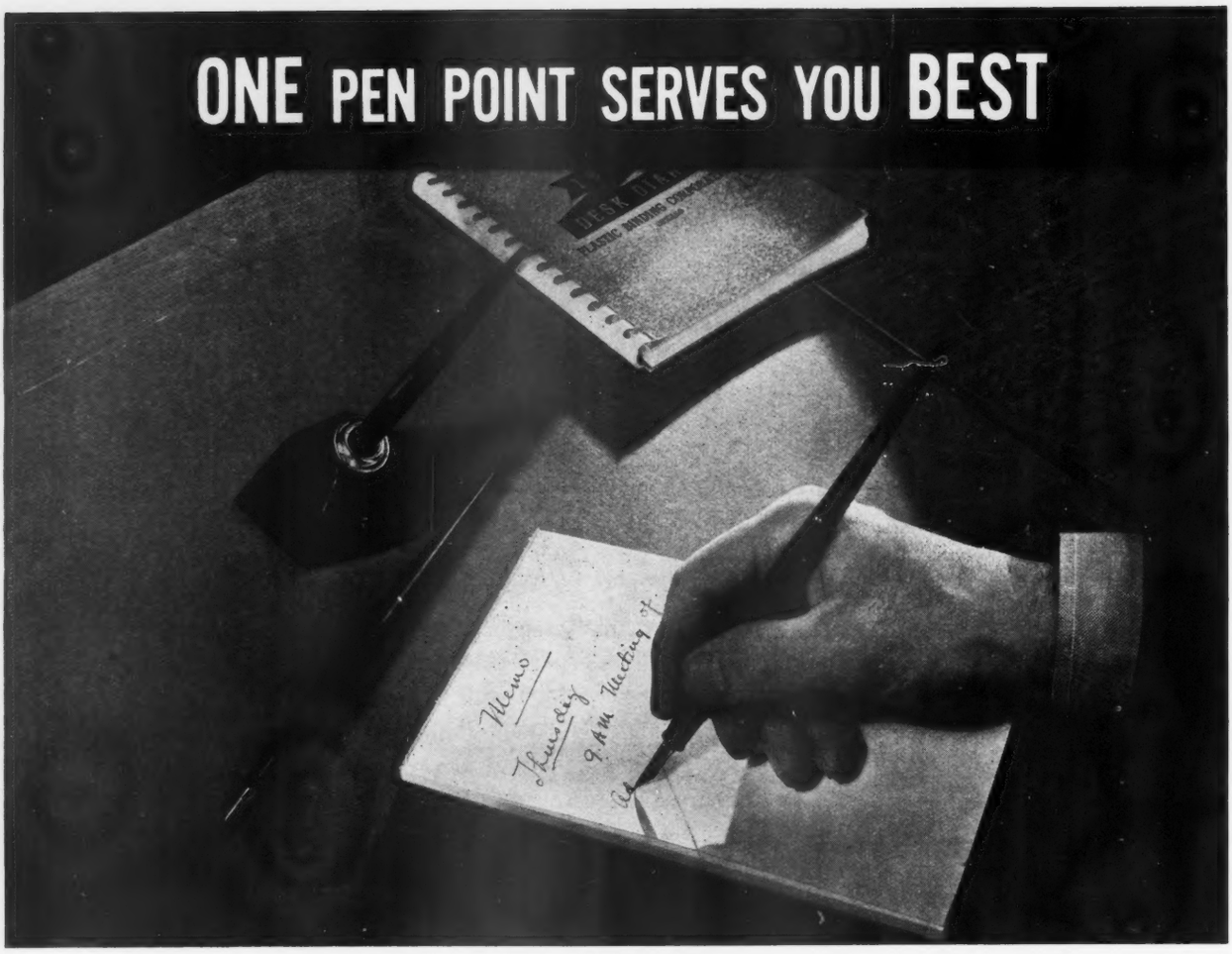
ONE PEN POINT SERVES YOU BEST



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BALL bearings, too, may look alike. Performance, however, depends not on looks, but on the ingenuity that has shaped their design, chosen their material, planned their manufacture.

New Departure preeminence in every phase of ball bearing production cannot be exactly duplicated. There is no substitute for New Departure's research, for its resources, its knowledge born of vast experience, its creative engineering.

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NEW DEPARTURE

WORLD'S NO.1 BALL BEARING

2674

L. C. MORROW • EDITOR

Factory
Management and Maintenance

Management Accepts Responsibilities

INDUSTRIAL MANAGEMENT in the United States recognizes and will fulfill its social and economic obligations. Such is our conclusion after attending the Seventh International Management Congress in Washington a few days ago.

The Congress provided a forum at which management had the opportunity to re-examine itself in the spotlight of public scrutiny. It did so with a result both revealing and comforting.

On other pages of this issue are high-spot abstracts of addresses made at the general sessions. On this page, in the numbered paragraphs, we attempt to high-spot the high-spots, to give a concentrated summary of management's own recognition of its responsibilities.

1. There are inherent responsibilities in management with respect to the public, employees, stockholders, customers, vendors. These responsibilities establish the necessity for performing the management function without undue assumption of power and with full respect for the tacit privilege of doing business.

2. Social advancement is dependent upon the constant improvement in technology and the increase in productivity per individual. Management has, therefore, the responsibility to conduct research in the creation of new employment, and to aid in the equitable distribution of gains from technical progress to employees, public, and owners.

3. It is industry's obligation to take upon itself the creation of demand for new products and services that ultimately result in the improvement of standards of living.

4. Industry should constantly seek to provide better values at lower costs so that more of our people can enjoy more of the world's goods.

5. Industrial management must cooperate in bringing about the essential readjustments necessary for harmonious and fruitful living in a congested society. It must take constructive action in attaining a form of social security that will also insure the maintenance of individual incentive.

6. Management recognizes those human considerations beyond wages, hours, and working conditions, which the employee rightfully expects from management.

7. It is management's duty to be alert to its own shortcomings, to the need for improvement, and to new requirements of society, while always recognizing the responsibility of its trusteeship.

To us these expressions on the part of management indicate a breadth of understanding and an acceptance of responsibility that merit the confidence of labor, the public, and government.

Tires in 4½ hours! Better tires that more and more people can afford to buy. Good handling gets much of the credit for results at the new Ford factory

Handling in FORD'S NEW TIRE PLANT

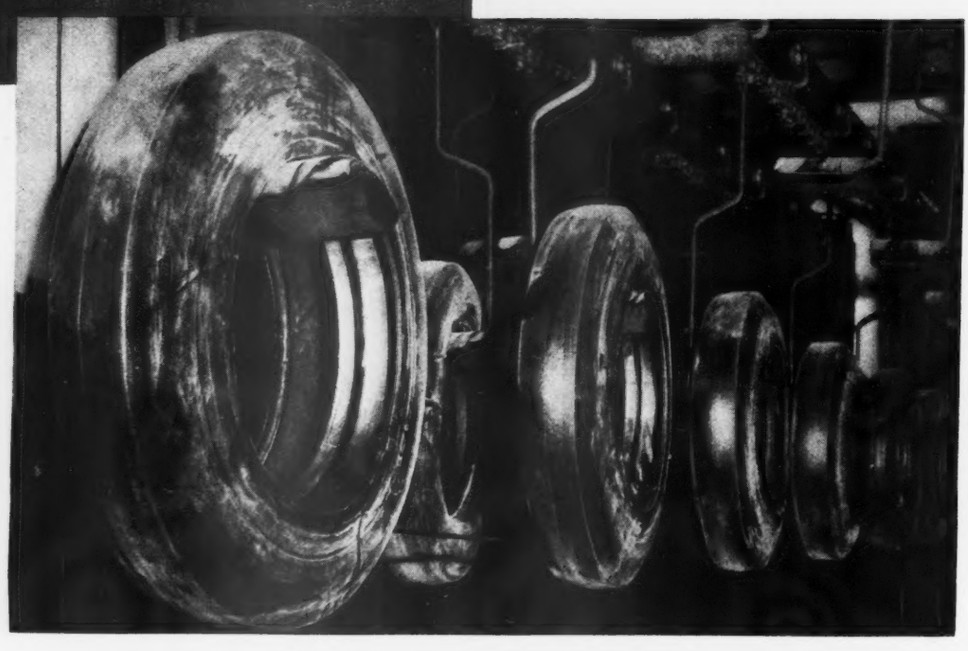
ARTHUR VAN VLISSINGEN
Consulting Editor

WHEN FORD Motor Company builds a new factory, you may be certain it will be designed to standards of productivity and time-saving far beyond anything previously considered orthodox. Henry Ford has a horror of using more time or human effort than the least possible for doing the job in hand. To waste time or manpower violates his basic concept that what the world needs is more *per capita* production at ever lower costs.

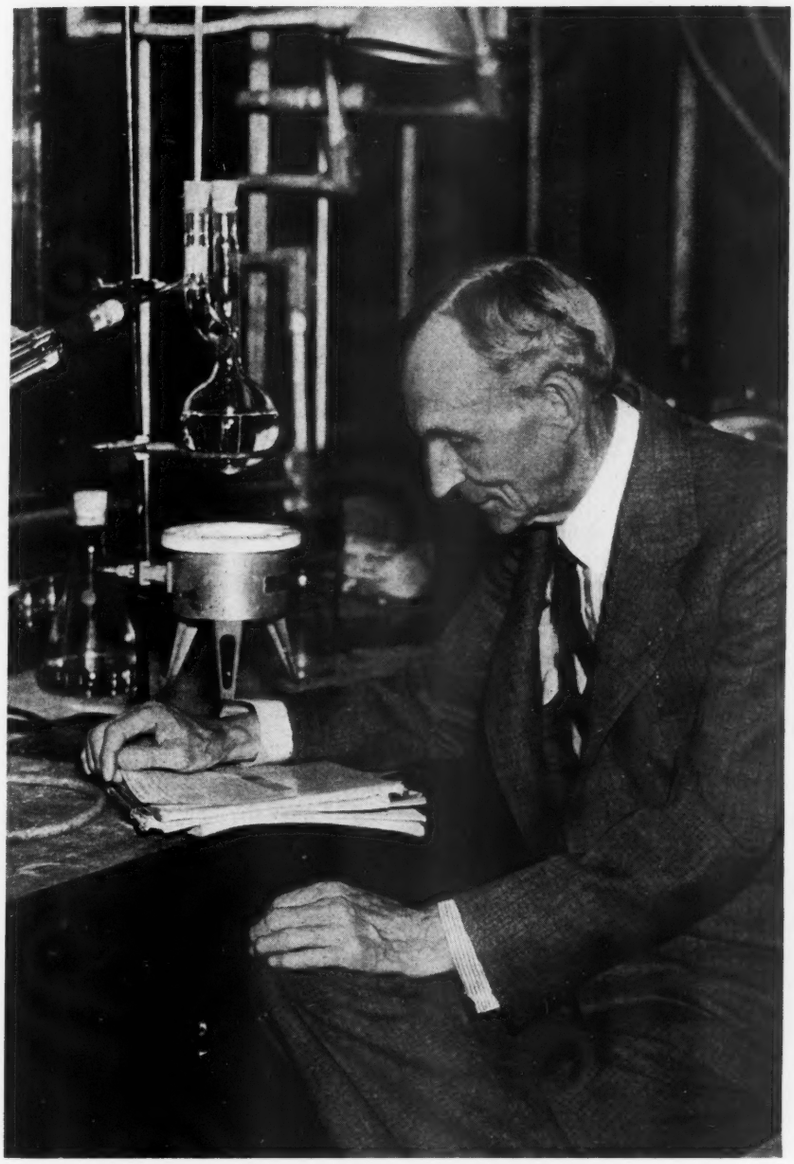
So, in designing the automobile tire plant that has recently gone into production at the huge Rouge Plant, Ford engineers cast overboard many treasured traditions of the rubber industry. The consequences are a cool, clean plant producing more tires per man than anything ever before known, and turning out the finished tire in 4½ hours instead of the conventional week or more from crude rubber to finished product.

A Common Denominator

Largely responsible for the economies in time and cost is the mechanical handling throughout the plant. The handling system is as yet by no means complete. The plant had to get into production before all the details could be worked out, and there are gaps across which hand trucks or temporary equipment transfer material in process. But there are already sufficient installations in view to offer a great many usable suggestions to production executives whose problems and products are far removed from the minor details of tire-building. After all, mechanical handling is a



Green tires move via overhead chain to curing lines where one tire layer tends 68 vulcanizers



Henry Ford hates to see men's time and efforts wasted. So this clean, cool plant whose handling is so good that one might almost say its tires are "untouched by human hands"

common denominator of every modern industry, however it may outwardly differ from every other industry.

For economy in receiving raw materials and for shipping finished tires to Ford assembly plants that may be reached by waterway, the tire factory was built on a dockside site. Crude rubber comes in by boat during the Great Lakes shipping season, by rail during the rest of the year.

Plans call for a conveyor to bring the 25-lb. bales into storage. Meanwhile they are handled by power trucks and stacked on the floor. When needed for use, the bale is picked up by an electric hoist and set on the slat conveyor on which it moves into production.

All activities that are not strictly production are concentrated on this ground floor. Here also are some of the preliminary processes of getting materials into actual production. The metal bands of the bale are cut on the conveyor and taken away by a workman, and superficial impurities such as lint are removed with a blowtorch. Now the crude rubber passes along to one of two cutters, depending on whether the stock is smoked sheets or amber. (All the way from storage to compounding, these two grades move in parallel lines through separate but almost identical equipment. For simplicity of comprehension, only one of these lines will be described.)

The crude rubber is automatically fed into its cutter, emerges on a belt conveyor. This conveyor carries the rubber through a preheating room. At the end of the room, the rubber is diverted, falls to a slightly lower belt, is carried back to the starting end. Here it is again diverted to a still lower belt and carried to the far end, where it emerges. This method permits doing the preheat job in a heating chamber only one-third as long as would be necessary without the 3-level conveyor.

The rubber continues on the same belt to a plasticator, a machine that breaks up the material and extrudes it in condition so that it can be worked. Extruded strips, cut into convenient lengths for handling, are hung on hairpin hooks on an overhead chain conveyor extending about 2,000 feet. The chain carries the rubber to the next process, on the third-floor balcony. The length of the chain is designed to cool off the rubber by the time it reaches its destination.

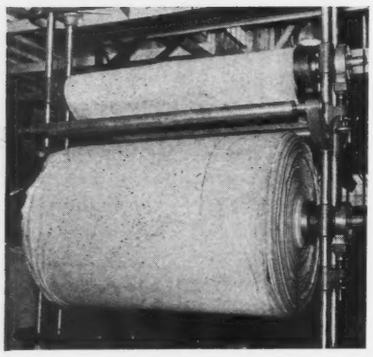
Will Work Elsewhere

Let us temporarily leave the plasticated strips hanging on their conveyor, and look over the other materials received on the ground floor. Each material presents its individual problem of mechanical handling. A good many of the methods used to solve these problems might be equally effective in a factory making foodstuffs or locomotives.

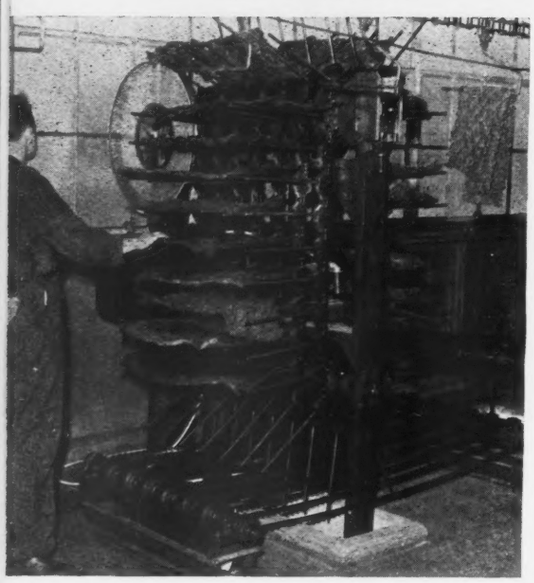
Latex, rubber in liquid form, arrives in tank cars, flows into the ground level tanks by gravity. From here it is handled by air pressure instead of by pumping, to deliver it to the points where it is needed in production processes.

Cord fabric storage is on the ground floor. The material is used on the second floor. It goes upstairs on an overhead chain conveyor equipped with an unusual hook fixture. The material comes in spools containing 12,000 yards apiece. The chain has to go upstairs and change direction, which means that it has to turn upside down. So the spool is suspended on a hook arm projecting stiffly from the side of the conveyor. The hook ends in a swivel joint permitting it to remain in the same position relative to the floor, despite the motion of the chain and arm, and thus keeping the spool suspended without any lock-on device.

Softener, a tar-like substance used



Fifteen of these special carriages serve the two calender trains



Batches from the weighing-conveying unit move through floor openings to the mixers on the floor below

in compounding, comes in coil-equipped tank cars. It is heated, pumped into ground-floor tanks, then at the same temperature is pumped to the fifth floor and eventually flows down to the compounding operation in a mixer.

Carbon black is purchased in granular, easy-flow type rather than the usual fluffy grade. It comes in a tank car, is dumped into a hopper. Here a screw conveyor pushes it away, another screw conveyor comes in at right angles to move it into the building, and finally a third screw conveyor carries it up to the fifth floor into a storage tank. From here it flows to compounding operations as needed.

Feed of this material is handled through an electric-control switchboard. By pushing the proper buttons, the man handling the pigment storage is able to control the gates and valves leading to the mixers. Telltale lights on the board confirm positive operation. Thus the carbon black, usually a source of dirt and smudge in a tire factory, is kept entirely out of the air —with pleasing savings in cost, too.

Other incidental pigments and compounding ingredients are stored on steel skids and handled with a power truck of 40-in. lift capacity. These pigments are dumped into the fifth-floor hoppers by hand. The job is one of those that can be conveyorized, but this probably will not be done since one man handles the entire job without any really heavy labor. It is cheaper thus, because one man would be required, even though it were conveyorized, to keep an eye on their operation. Stearic acid, now placed in a heater by hand, will eventually have a conveyor feed; it is kept hot and fed by gravity into the mixers.

Weighing-Conveying Unit

We left the strips of plasticated rubber traveling on the hairpin hooks of the overhead chain conveyor from the ground floor to the fourth floor balcony. Here it reaches a weighing-conveying unit which consists of parallel chains traveling up, around, and down an elevator-type circuit; it is about 5 feet high, equipped with rods making open shelves. The entire unit is mounted on a scale set to read zero until rubber is loaded on the shelves.

The overhead chain conveyor brings up the plasticated strips of smoked sheet and of amber rubber. (It is planned to shift this conveyor to double-hairpin hooks instead of single as at present, so that a trip of smoked sheet can occupy the upper hook and a strip of amber the lower.)

The operator at the weighing-conveying unit takes off enough smoked sheet for a batch, as shown on the scale. Then he takes off enough amber. To them he adds smaller quantities of other rubber material, rotating the unit to accommodate the load. When the shelf passes over the top to the opposite side of the unit, the rubber on it falls onto the other side of the next shelf.

Down to the Mixer

At the bottom of the elevator cycle, the rubber falls on a take-away conveyor and the operator pushes a button to direct it to the proper mixer. The mixers are on the floor below, in a line. To serve each one, there is an opening in the floor of the balcony where the weighing occurs.

Leading from the weighing-conveying unit is a multiple chain so designed that the unit above the opening can be lifted by remote control from the push buttons at the weigher's station. Therefore, when he thus lifts this section, the rubber moving forward on the multiple-chain conveyor falls through the floor opening serving the mixer for which the batch is destined.

When the rubber falls through the opening, it is caught on the surface

General view of bagging and curing departments; control units at top right

of a belt conveyor just under the ceiling of the lower floor. This belt carries the rubber to the mixer, and is so tied to the up-stairs multiple-chain conveyor that it moves only when the upper conveyor is started in motion to drop a load upon it. Then the belt makes just half of a revolution, moving the load up close to the mixer but not into the mixer. Under the present set-up, the mixer operator sets the belt to move the batch into his mixer. But in the final layout this will be handled by a control board, and the contact on the control board will move the batch ahead. Either way, a batch sufficient to load the mixer is always waiting on the belt conveyor.

Into the mixer along with the rubber must go pigments and other materials. These are handled through automatic scales over which they pass on the way from top-floor storage. A double-conveyor type scale is set to weigh carbon black, drops it as needed. If by any mischance the batch is not ready for the next mixing cycle, the system shuts down and will not operate until all is correct.

From the scales that handle material that flows through pipes, these materials discharge directly into the mixing chambers. For ingredients that need conveyor handling, an ingenious design obtains double service from each conveyor. Each scale discharges on a concave belt conveyor that can travel in either direction to serve either of two mixers. At each end these belts discharge in turn to two concave belts traveling at right angles and toward their respective mixers.

Panelboard Controls

Time and cycle of each mixer are controlled by a panelboard that closes doors and opens valves. At the end of the mixing operation, when it reaches the time and temperature for which it is set, the panelboard automatically dumps the mixer contents on the mill below. Telltale lights on the board show positive operation.

These panelboards now have supplementary hand controls, placed there to care for possible difficulties in operation. However, with the successful experience of a few months' operation, the control of all the mixers will soon be concentrated on a single panelboard with full automatic control, and one man will thus control all twelve mixers. Temperatures are recorded by automatic instruments.

As the compounded rubber emerges from the mill, the operator cuts off a small sample. Directly at his machine is a pneumatic tube station. He places the sample in the carrier, sends it on its way to the laboratory. In 20 minutes the laboratory report is ready. If approved for use, the sheets now are placed on skids and moved ahead to the next process. For cooling, the sheets are now dipped; this is a temporary method, to be replaced with spray-cooling on a conveyor for precisely the 20 minutes required for the laboratory report.

Conveyor moves ply stock from rotary bias cutter to two rows of tire builders

Next the sheets go to a warm-up mill and are cut into strips. This strip travels in a continuous strip supported on an overhead belt conveyor to the tube machine. The extruded tread travels on three successive belts, each at a slightly different speed to take care of shrinkage while the material is being cooled through air and water.

Serving the Calenders

Rubber-coated fabrics after calendering must be rolled up with liner fabric, to keep the material from sticking together. This operation has, since the opening of the plant, involved handling the heavy rolls back and forth with hoists. Very recently there has come into use a new type of handling equipment, consisting of a heavy hand-push carriage on a tramrail. There are fifteen of these carriages now in use, serving the two calender trains in the tire plant.

Each carriage has two rolls in fixed position. When one of the carriages goes into operation, the upper roll contains 500 yards of liner fabric. Each roller on the carriage has a hand-operated brake. The tramrail leads from the storage space to the above-mentioned calender trains and then on to finished storage.

Via the Overhead Rail

On the rail, the carriage can be pushed into line with the calender take-off, where the spindle of the roller fits over a drive-shaft actuated by a motor in the base; the drive-shaft connection is adjustable vertically to engage the socket.

Now the rubber-coated fabric is threaded on the lower roller and the liner fabric is threaded on with it. Starting up the motor makes the rubber-coated and liner fabrics roll together on the lower roller. Staying on the monorail, the loaded carriage may

now go on to storage for subsequent use, or direct to the next operation, the bias-cutting machine.

At the bias cutter the rubber-coated fabric is threaded on the feed of the machine, still on the carriage. The upper position of the carriage base at the bias cutter has a motor-driven socket to roll up the liner fabric. The liner fabric is threaded onto the upper roll of the carriage, where it rolls up as the bias cutter unrolls the rubber-coated fabric from the combination roll. With the rubber-coated fabric all used up by the bias cutter, the liner fabric has simultaneously been accumulated once more on the upper roller of the carriage, just where it was at the moment of use at the take-off of the calendering train.

Ready for Curing Operations

The carriage, with its roll of liner fabric ready for re-use, is now pushed off on a sidetrack of the monorail system until it is needed again at the calender for a new load of rubber-coated fabric on the bottom roll.

From the bias cutter, a broad belt carries the rubber-coated fabric pieces to the tire-builders' stations. Here the tires are made on special machines, with the parts of the tire built on around a drum. Now the green tire looks like a small barrel, is ready for the operations that will first shape it and then cure it.

45 Minutes to Cure

From the tire-building operation, the barrel-shaped work comes on an overhead chain conveyor to the man who fills each one with a bag that is something like an inner tube. There is one bagger for each double curing line. A curing line consists of 34 molds, or vulcanizers, and one mold tender or tire layer takes care of two lines, 68 molds. The molds open automatically at the end of the 45-minute curing cycle, and the tire layer walks down one line removing the cured tires and laying them on the take-off belt conveyor under the mold line.

Since it takes the tire layer just 45 minutes to make the circuit of his double line, the molds pop open just ahead of him as he makes his rounds.

A separate overhead chain conveyor serves each side of his line. As fast as he removes the cured tires, he takes green tires from this overhead chain and refills the molds. This overhead chain is standing still; it holds a tire at each mold station ready to his hand.

While the tire layer is working up one side of his circuit, the bagger who serves his lines is producing work at exactly the same rate. The overhead chain conveyors come to the bagging machine, and the bagger loads his green tires on the chain on the side opposite where the tire layer is working at the moment. Each time the bagger loads on a green tire, he steps on a switch and the chain moves ahead one station.

Close Coordination Here

There are 34 stations on the chain, spaced to correspond with the mold spacing along the curing line. Thus, just as the bagger fills all 34 hooks on a chain, the tire layer finishes the other side of his circuit, steps across and starts using these green tires as he empties finished tires off this line. The bagger meanwhile is busy for the next 22½ minutes filling up the conveyor chain that serves the side that the tire layer has just now emptied.

The cured tire is carried by the belt conveyor to the de-bagger, where the bag is removed; the tire is trimmed and hung on an overhead chain conveyor with spindle fixtures. The spindle is needed because it permits the inspector to spin the tire without removing it from the conveyor.

Now it passes along to the first balancing test, then goes on a gravity roll conveyor where the inner tube is put in and inflated. This roll conveyor intersects with a belt conveyor, at which junction it is removed and given its final balancing. It now moves a few feet to a take-off station. From here it goes on to the shipping platform. At present this move is made with large four-wheeled hand trucks, but an overhead chain conveyor is being erected to deliver the finished tires direct from the final balancing station to the freight cars.

Simpler Than It Sounds

The description of the mechanical handling operations in this plant is necessarily more formidable than the handling itself. Actually, it is simplified to an almost incredible extent. And when all the links of the internal transportation system are completed, they will make the operation even faster and more economical. It will mean, if we know anything about Henry Ford, an even better product made to sell at prices more and more people can afford to pay.

A Balcony for Storage

SOURCE

Baldwin Piano Company
Cincinnati

Possibilities of gaining much needed space for storage are often overlooked in plant areas where the ceilings are only moderately high and a balcony, therefore, is not thought of. In this plant a storage balcony was put in under a 16-ft. ceiling, with excellent results. The balcony was erected on iron posts and steel cross members. Cost of construction was low.

There is adequate headroom on the balcony for a man to move about without stooping, and there is ample headroom between the working floor and the mezzanine. The storage space provided makes it possible to keep a sizable bank of materials directly above the work area. Yet this is accomplished with no loss of working space.

W. C. ZINCK
Industrial Engineer
North & Judd Manufacturing Co.
New Britain, Conn.

QUICK DELIVERIES, Because . . .

There's real production control in this 200-man plant—control of more than 1,500 items in several finishes—and in an industry that wants what it wants when it wants it

PRODUCTION CONTROL is successful only when it is so built around the peculiar customer demands of the industry, the variety of the articles, and the manufacturing operations, that it provides adequate customer service at minimum expense. The control to be outlined covers 1,500 items in three or more finishes sold to a trade that will not anticipate its needs, but expects immediate deliveries from stock.

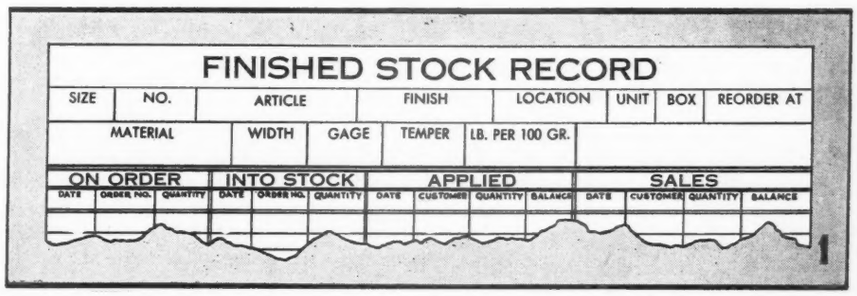
Low inventories of raw materials and finished goods are maintained through the material control plan described in my earlier article.* Quick, sure delivery of raw materials allows fast-moving finished stock to be replenished currently. A short manufacturing cycle, and adequate originating equipment—blanking presses, and wire-forming machines—also help to keep finished stock down.

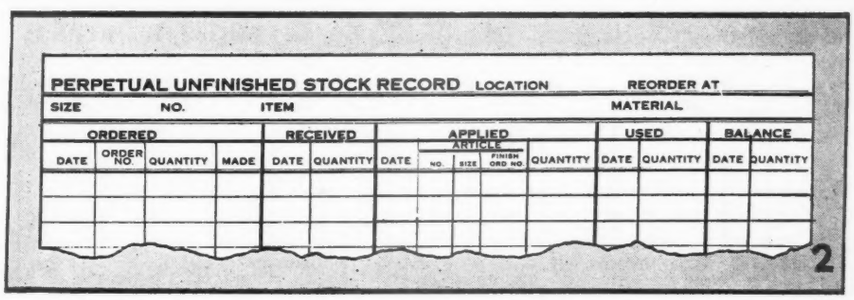
A further aid to low inventory is carrying unfinished stock on fast-moving items ordered in different finishes. Thus part shipments can be made at once against a large order, with the balance following promptly by finishing unfinished stock.

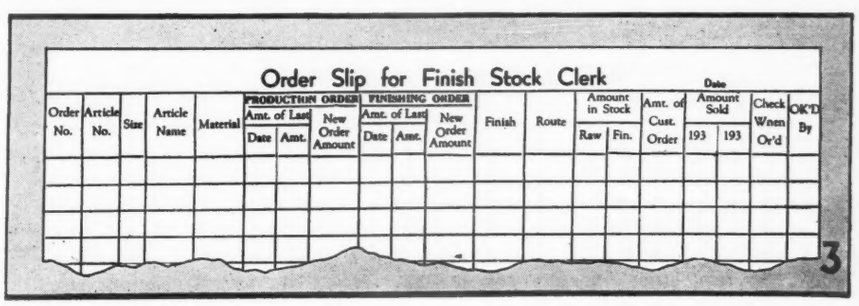
Three clerks handle the control system—a stock record clerk, a production record clerk, and a production clerk. Supervision is one of the manifold duties of the superintendent and the works manager. This small personnel justifies the claim of service at minimum expense.

Control routine includes perpetual records of finished and unfinished stock on each item; anticipates customers' orders as much as possible; places factory orders with minimum delay; refinishes slow-moving finishes into faster-selling finishes; forces promised orders through the factory; keeps stock orders moving regularly through the departments; helps department foremen keep production flowing; keeps the superintendent and the works manager informed as to progress and hitches, or spots to be bolstered up and forced into line so that maximum production and customer satisfaction are obtained.

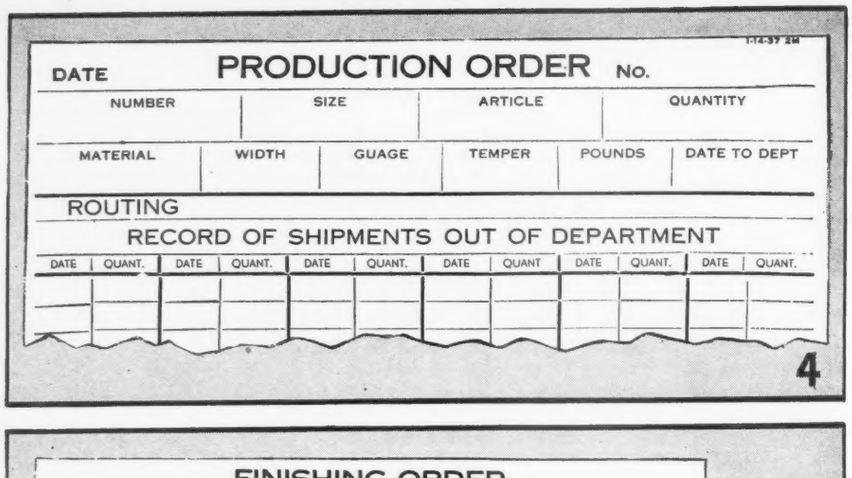
The perpetual inventory of finished stock (Figure 1) provides a card for

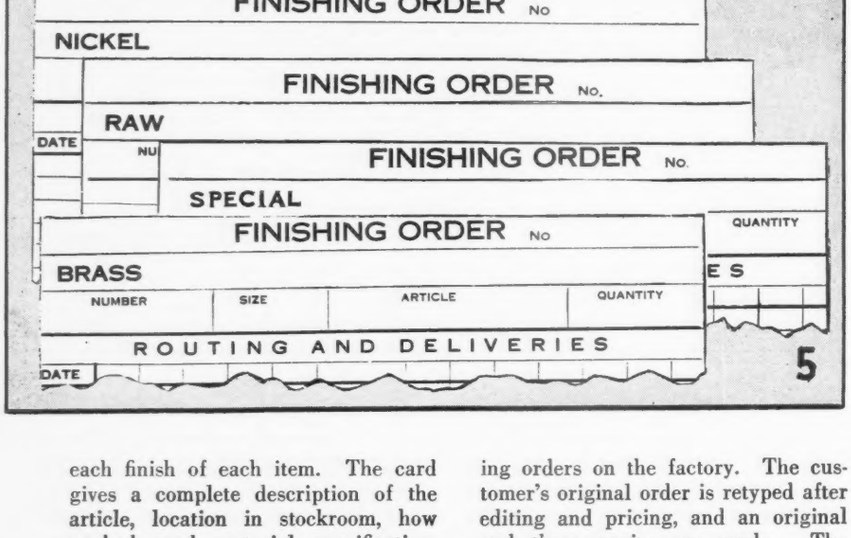






* "Low Inventories Because—" (July, 1938, page 65).





each finish of each item. The card gives a complete description of the article, location in stockroom, how packed, and material specification. In the "on order" and "into stock" columns are recorded the finishing orders placed in the factory and the receipts into finished stock against these orders.

Under "applied" are posted the incoming orders with date, customer's name, and quantity. A running balance is kept of all orders unshipped. Date of shipments, customer's names, and quantities are posted in the "sales" column. The balance column is the perpetual inventory of finished stock.

Figure 2 shows the perpetual inventory of unfinished stock. A card for each item gives its description, location, and material. Columns are provided to show dates, order numbers, and quantities placed in the factory together with quantities received against them; dates against finishing-order numbers and quantities applied; withdrawals as to dates, finishing-order numbers, and quantities, and the perpetual balance. The activity of the item is evidenced by the receipts and withdrawals, invaluable information to the stock record clerk in placing factory orders.

Anticipating customer requirements is combined with the routine of placing orders on the factory. The customer's original order is retyped after editing and pricing, and an original and three copies are made. The original of the retyped order now goes to the stock clerk, who applies the items to the stock cards and corrects the applied balances. The unspecified balance—the difference between total stock on shelves and total unshipped applications for each item—is then checked with the reorder points to see if the finished stock must be replenished.

If Sales Are Slowing Up

Reorder points are not followed blindly, however. If sales of an item are slowing up or increasing noticeably, the clerk checks with the sales department to have the reorder point adjusted. If finished goods must be made, the clerk checks the unfinished stock card for the item in question. If the unspecified balance of raw stock is sufficient, a finishing order only is requested. If the finishing order brings the unspecified balance below the reorder point for the raw stock, a production order is then requested to replenish the unfinished stock.

As the stock record clerk analyzes the stock situation for each item, requests for finishing and production orders are made on the form illustrated in Figure 3. This takes little extra time; it merely means jotting down the data as the analysis is made.

It is through this order slip that the superintendent supervises the production control. The slip goes to his desk after each bunch of customers' orders are passed by the stock clerk. The data on the slip enable him to specify new amounts on the factory that will reconcile low inventory, economical run, and customer service.

A Valuable Guide

The "amount of customer's order" column is a valuable guide. It is the last order applied to the finished stock card or the unfinished stock card that sets in motion the replenishing routine.

If it is small, and the raw and finished stocks are near normal, and if the demand on the item is slowing up, or if the equipment needed is under repair, or if equipment is running heavy on larger, more urgent orders, the superintendent will not accept an order on the factory, as it can wait until the next customer's order is received.

If the customer's order is large, it informs the superintendent at once that the factory orders are important and must go through complete. Also, in placing orders for the raw materials against production orders, it is valuable to know the amount of the customer's order. If it is small, it will often be economical to substitute materials and run just enough to meet the customer's requirements; if large, the purchasing department can be informed not to accept partial shipments.

In other words, without this information, regarding the size of the customer's order, all requests for factory orders look alike. With it each is different and is handled with discrimination.

The sales department must continually enter the production routine to the extent of closing out slow-moving finishes and finished stock and respecifying reorder points. If the sales are increasing, the reorder points can be raised. If sales are dropping the reorder point can be lowered even to the point of carrying no stock and making special on receipt of an actual order. Also instruction can be given the stock clerk to close out slow-moving finishes by refinishing to fill customer's orders.

Service to the customer is stressed in handling the three copies of the retyped customer's order. The shipping copy goes direct to the shipping department and is the authority to

ship what goods are in stock. The tickler copy goes with the shipping copy. If the order is shipped complete, the tickler is destroyed. If the order cannot be shipped complete, the tickler is marked to show what items are not in finished stock, and is sent to the works manager.

After taking notes from the unfilled orders for discussion with the production clerk, the works manager sends the tickler copy to the desk of the production clerk. The production copy of the order goes with the original to the stock clerk's desk. As the clerk analyzes the items and asks for the necessary factory orders, notations are made on the production copy of the necessary factory work before shipment can be made. No notation means that the item will be shipped from stock, the notations "refinish," "from unfinished stock," and "production order" indicate clearly the starting point and amount of factory work.

The edited production copies go to the production clerk to be matched with the tickler copies from the shipping room, to see if every item expected to be shipped from stock has been. If the tickler copy shows an unfilled item that is indicated to be shipped from stock on the production copy, something is wrong. To reconcile, in such cases, the finished stock inventory with active goods on the shelves, and to see that either the goods are found or factory orders issued to cover the balance, is a function of the production clerk.

The Final Tie-In

Promising shipping dates on incoming orders is the final tie-in of the routine control that anticipates customers' requirements, places factory orders with a minimum of delay, and forces work through the plant. Each customer order is initialed by the works manager and those to be given promised shipping dates—i.e., factory preference—are stamped "promised" by him. Seeing customers' orders before they are typed, enables the manager to inform the superintendent and the production clerk immediately of any special work, so that special preparations can be made to help save that "last day" so hard to make in keeping promises.

Lost orders and orders set aside and forgotten are checked through the tickler copy of the order, and through a monthly total of unshipped business. The tickler copy is returned to the shipping room by the production clerk after it has been checked against the production copy to be filed by dates. As orders are finally shipped complete, the tickler copies are removed and destroyed.

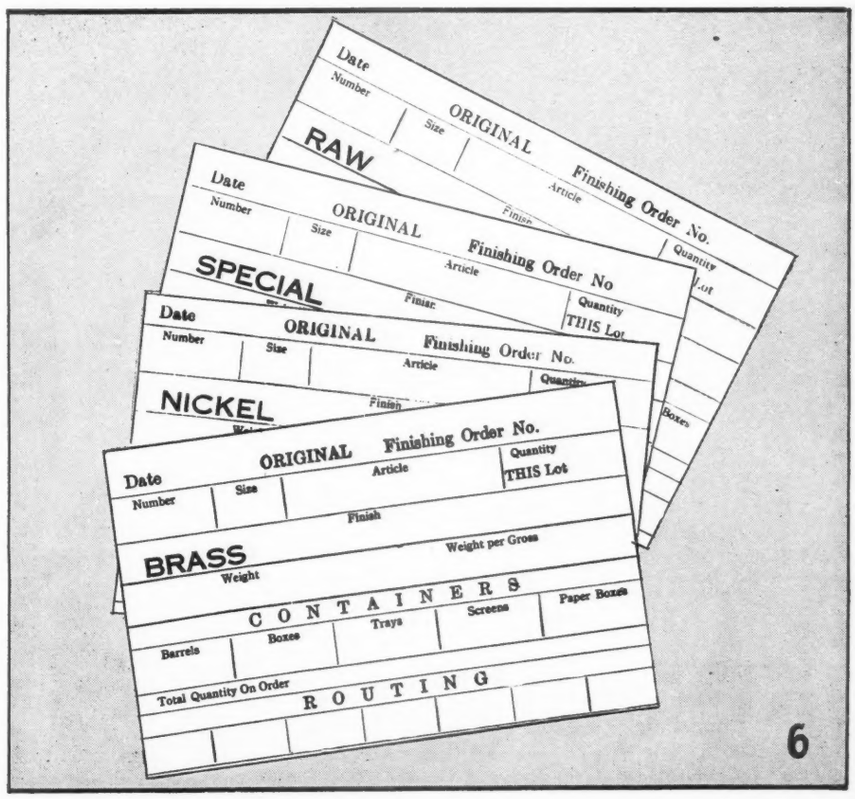
Each day the tickler copies of all orders received a month previous to that day are removed and sent to the works manager. These are discussed with the production clerk and have proved a valuable check.

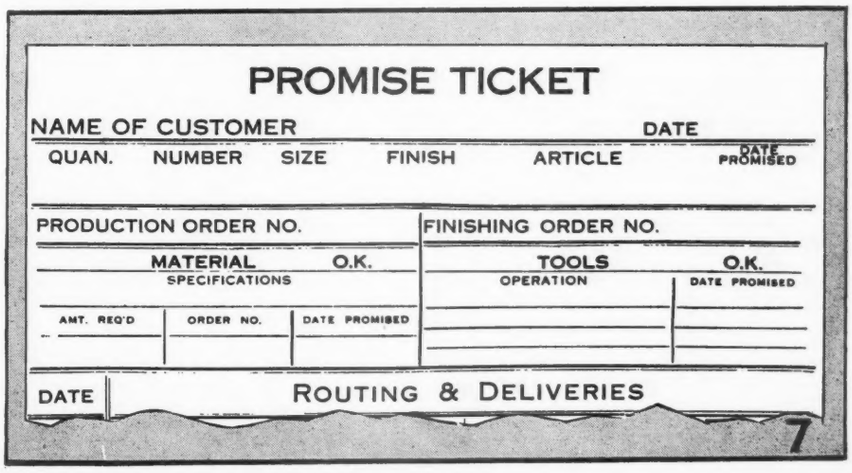
At the beginning of each month the production clerk and the stock clerk obtain, from the office copies of unshipped orders, a total value of unshipped business. This compels every order to be scrutinized minutely, forcing the production clerk's attention to any orders that have been lost in the factory, or somehow or other set aside.

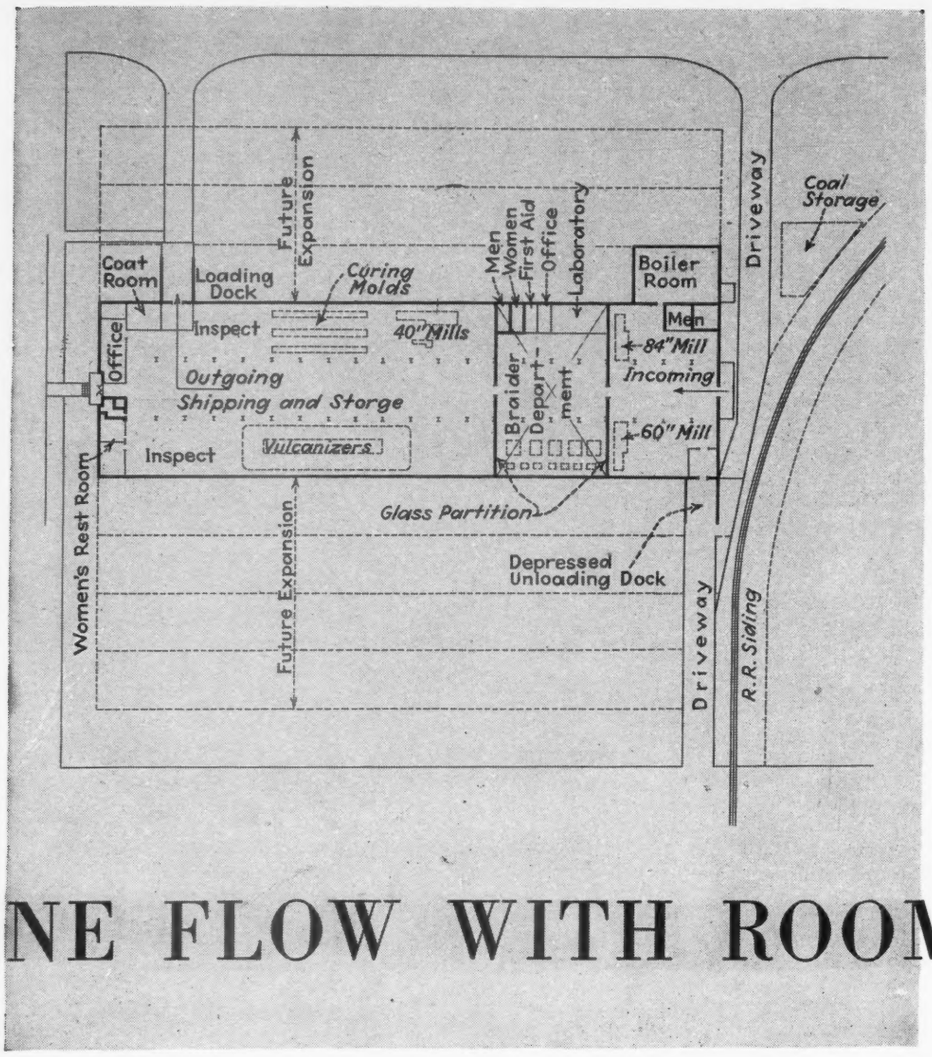
Blanket orders, or orders for future shipments, are general practice in the industry. On the first and fifteenth of each month, stock clerk draws off a list of future shipments for the guidance of the production clerk and the sales department. All future shipments to be made within the next two weeks are placed on the "promise sheet" of the production clerk. The tickler copies of blanket orders a month old show if any releases have been given with the first month. If not, the tickler goes to the sales department as a request to have the outside salesman endeavor to secure a release.

What per cent of customers' orders are shipped from stock? That is the answer to any routine designed to anticipate customer's requirements and

(Continued on page 118)







BEE-LINE FLOW WITH ROOM

L. K. URQUHART
Associate Editor

Straight-line manufacture with provision for expansion marks new hose plant recently put into operation by The DeVilbiss Company

THE proverbial winging of the bee from the honeysuckle to the hive has little or nothing on the production flow at the new DeVilbiss plant in Toledo. Here the layout—see the chart at the top of the page—provides for straight-line passage of goods from the back of the plant where raw materials are delivered, prepared, and milled, toward the front of the building where finishing, inspecting, packing, and shipping departments are located.

Nothing, in short, has been overlooked in the planning of this up-to-the-minute manufactory — nothing, that is to say, that makes for low-cost production. There is even the careful provision for future needs that always should be, but more often is not, included in the early stages of planning the new plant, and which even when originally included is so apt to go by the board before actual construction gets under way.

There are many obvious advantages to this type of manufacturing layout —too many and too obvious, in point of fact, to require enumeration in this brief space. We shall content ourselves, therefore, with directing attention to the easy-to-read floor plan and the self-explanatory photographs, the while we describe a couple of things you ought to know about.

First, note the clear glass partitions that divide this plant into four main sections. The idea, of course, is to confine mill odors and dust to the mill room proper and keep the rest of the plant sweet and clean. Which is a big step toward making this type of manufacturing establishment a first-rate place to work in. It is perfectly obvious, too, as some of our more cynical friends delight in pointing out, that the quality of the product, hence that thin black line of profits, is by no means lessened by this enlightened practice.

The other thing we must call attention to is the neat job of handling done in the vulcanizing section.

Here tubing that has received its extruded cover goes to the lead press where it is encased in lead and wound on steel reels preparatory to vulcanization. The reel is loaded on a truck by an electric monorail hoist, and the truck rolls on rails into one of the two large vulcanizers.

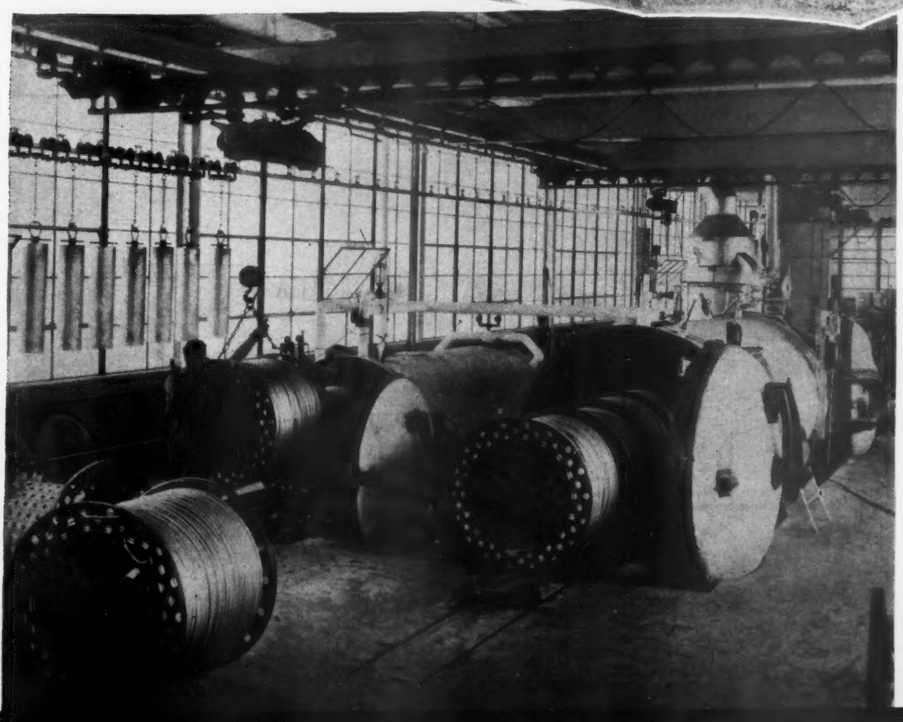
After vulcanization, the hose goes to a stripping machine which removes

the lead cover and prepares the metal for melting in a lead pot alongside. (If you're getting lost, take a look at the bottom photograph.) The lead is here cast into ingots and moves forward on a monorail (which you can see at the left of the same photograph) to the lead press where the metal is applied to the next batch of hose.

From this point the hose moves to the cleaning unit, whence it emerges as a finished product ready for inspection, packing, and shipping.

Directly across from the vulcanizing section are two 40-in. mills, two tubing machines, a calender, cut-out presses, curing molds, buffing, dusting, and drilling machines used in the manufacture of various other rubber products made in the plant. After washing and drying, these products pass to the inspection tables where they are sorted for transfer to assembly and finishing departments in another plant.

TO GROW



Principal steps in hose and bulb production are carried on in the 260-ft. daylight department shown at the top

Continuous monitor sash insure good light and air in the three 40-ft. aisles of this modern rubber factory

Vulcanizing operations are notable for the ease with which heavy loads are handled through the department

Describing an efficient payroll and cost system fashioned on automatic sort-card lines, but which sticks to hand sorting

Small Plant Adapts Big-Plant Cost Method

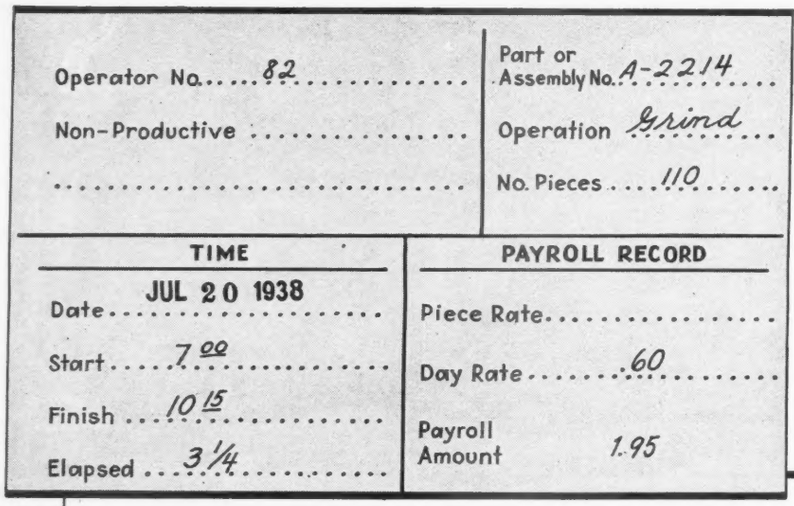
F. K. ZIMMERMAN
Cost Accountant
The Aro Equipment Corporation
Bryan, Ohio

AUTOMATIC sort-card machinery has proved indispensable to large manufacturing organizations for procuring and analyzing payroll and cost information. Smaller manufacturers, however, find that insufficient volume makes mechanical sort-card processes too expensive to apply, and often must rely on figures obtained by huge amounts of clerical work. This article describes a method that has demonstrated its worth in applying some of the automatic sort-card principles to an efficient and accurate manually sorted payroll and cost system.

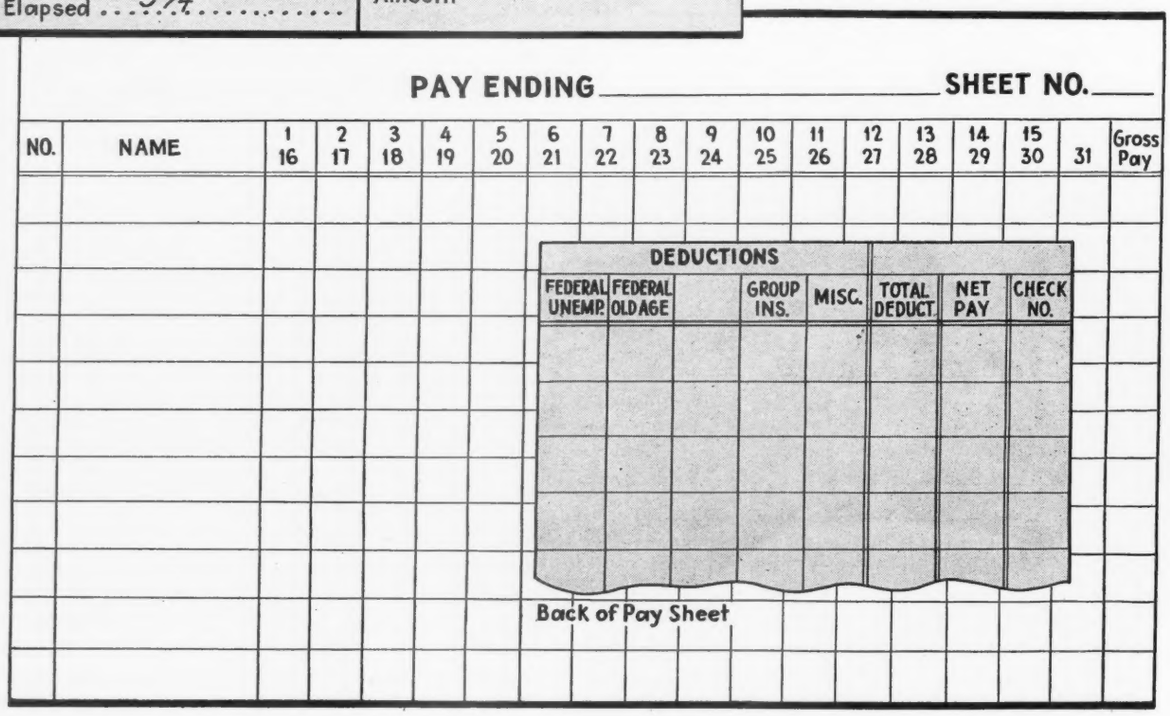
The primary objective of sort-card methods is to eliminate posting to summary or recapitulation sheets. Under the plan described, there is no posting to production orders or to indirect-labor expense accounts. The cards are written in once, and are sorted and filed in a manner requiring no further writing.

Figure 1 illustrates the type of card employed. The shop timekeeper fills in the part or assembly number, the number of the operator, the operation performed, the number of pieces completed, and the start and finish times.

If the work performed is non-pro-


Operator No. 82
Non-Productive
Part or Assembly No. A-2214
Operation Grind
No. Pieces 110
TIME
Date JUL 20 1938
Start 7 00
Finish 10 15
Elapsed 3 1/4
PAYROLL RECORD
Piece Rate
Day Rate .60
Payroll Amount 1.95

Figures 1 and 2. Direct-labor card and payroll sheet used in this manually sorted payroll and cost system


PAY ENDING _____ SHEET NO. ____
NO. | NAME | 1 16 | 2 17 | 3 18 | 4 19 | 5 20 | 6 21 | 7 22 | 8 23 | 9 24 | 10 25 | 11 26 | 12 27 | 13 28 | 14 29 | 15 30 | 31 | Gross Pay
DEDUCTIONS
FEDERAL UNEMP. | FEDERAL OLD AGE | | GROUP INS. | MISC. | TOTAL DEDUCT. | NET PAY | CHECK NO.
Back of Pay Sheet

ductive, a description or code letter indicating the type of activity is written in the space provided. An employee working on three jobs during the day has three cards made for him. The shop timekeeper clips each man's cards together and forwards them to the cost and payroll clerk.

Extending the Payroll

Elapsed time is calculated for each card, and the total for each man is checked against the "In and Out" clock cards. The payroll is extended by multiplying the elapsed time by the employee's day rate or the number of pieces by the piece rate. The total day's pay is then recorded on the payroll sheet shown in Figure 2, from which further payroll calculations are made.

After payroll figures are obtained, the cards are sorted into two divisions, indirect and non-productive labor. The non-productive cards are then sorted according to the distribution desired by the accounting department. A convenient plan for this sorting employs a set of pigeonholes marked with the various non-productive operations or code letters representing them.

At the end of the month or other accounting period, the cards are withdrawn from the pigeonholes, the payroll amounts are added, and a report of indirect-labor expense is made to the accounting department. The difference between the total of these non-productive items and the total payroll for the period will be the cost of direct labor.

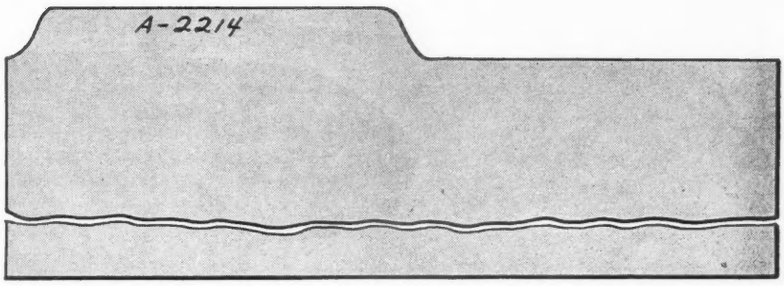


Figure 3. For each factory order a guide card. Time cards are filed behind it

The direct-labor cards are sorted according to the part or assembly number. When production orders are issued, guide cards (see Figure 3) are made. These guide cards are filed in numerical order in a filing cabinet. Day by day, then, direct-labor cards are filed behind the corresponding production-order guide card.

How Cost Is Calculated

When a production order is completed, the guide card and all direct-labor cards filed behind it are withdrawn, and the cost is calculated. If a cost analysis by operations is desired, the cards may be further divided according to operations.

Whether or not such an analysis is desired, the final step in procuring the labor cost of parts manufactured is to divide the total of "Payroll Amounts" shown on the cards by the number of pieces completed as reported by the production department.

Thus labor distribution and the labor element in costs have been determined with the use of the time cards originating with the shop timekeeper. No posting to cost summary or to other recapitulation sheets is necessary, and experience proves that sorting cards, even manually as this method provides, can be done in one-tenth the time required for posting. Moreover, the element of error in transferring figures from cards to sheets is eliminated.

This costing method does not purport to be a substitute for mechanical methods of sorting and analyzing, but a way through which some of their advantages may be employed by the manufacturer whose volume is too small for economical use of mechanical equipment.

Pre-Assembled Sheets and Rack Save Typist's Time and Effort

JOHN F. PIERCE
Director, Office Service Department
Tennessee Valley Authority

Easier work and increased production are the results

Motion economy, which works so well in the shop, may be applied with equal success in the office.

Note the set-up we use in typing cross-index sheets. At first we assumed that the conventional desk-drawer arrangement of paper and carbons was good enough. A little study showed us, however, that the sheets of paper and carbons could be pre-assembled. This immediately increased the typist's production. But we really approached efficient performance on this job when the pre-assembled index sheets were placed in a rack directly behind and over the typewriter. Now the typist feeds the sheets right into the machine in a straightline motion which utilizes the principle of gravity. Her work is much easier. Much of her time and effort are saved.

MANAGEMENT'S

LEWIS H. BROWN
President, Johns-Manville Corporation
New York

Complete text of a significant paper presented September 20 at the fourth general session of the International Management Congress in Washington. Mr. Brown's "creed of management" is suggested as the basis of a common meeting ground, not only for management and labor, but for all of us in dealing with current social and economic problems. Here's a target we can all shoot at

THE ESSENTIAL characteristic of the nineteenth century was that barter and trade and manufacturing were carried on like agriculture, as small businesses; they were conducted within local areas and managed by "owners" or "partners." There were but few large corporations.

But during the last 25 or 30 years. under the continuously exerted pressure of change in this and other countries, and with the new widespread ownership of business by millions of shareholders, there has been developing an entirely new type of business executive who is a professional manager, not owner. These new industrial executives differ widely from the owner-managers who preceded them in ideas, ethics, social concepts, and methods of management.

The principles of scientific management are as old as civilization. Yet it was not until the turn of the century that they first were clearly stated and applied to industrial operations. The principles on which this new profession rests were largely codified by Frederick W. Taylor, who was the founder of Scientific Management. He was followed by Harrington Emerson, who was the first to clearly outline the principles of efficiency. Both men exercised wide influence, not merely upon the thought of their own times, but over the minds of present-day business leaders.

These men thought of industrial efficiency in larger terms than merely profits.

They were equally concerned with industry's human relations, and with the harmonious coordination of men and machines.

One of the more serious handicaps under which industry operates today is the public's lack of knowledge of the extent to which this concept of enlarged social responsibility is now accepted by the present-day leaders of industry.

They're Ancient History

The public still thinks of management of corporations, and of business, in pre-war terms. But the modern world has moved so rapidly that those days and those ways are ancient history.

Twenty years ago B. C. Forbes wrote a book, "Men Who Are Making America," describing the careers of the 50 men then foremost in American industry, finance, transportation, and business. Today, of the 50 only 10 remain alive, and only 3 are active in business and the directing heads of their organizations.

What principles govern this science of management? What is the *philosophy*—the *ideals* which give them meaning?

In 1911, Harrington Emerson said:

"The Principles of Efficiency set forth a new view of the whole industrial problem. They define something infinitely greater than a system of management. They set forth a *morality* and provide practical measures for its attainment . . . It is the declaration of a New Philosophy."

"What about *man?* What about *humanity,* present and future? This is the test to be applied by every executive, because the ideal of humanity, *not the ideal of selfish gain,* underlies every principle of efficiency.

"In the last 150 years has occurred the substitution of coal, oil, gas and distant waterfalls for human, for animal muscular energy. Formerly man carried out his plans by forcing other men, by compelling oxen and horses to work.

"Now men carry out their plans by making uncarnate forces work. . .

"Today, on the average, each adult man is supplemented by 22 mechanical slaves.

"As a producer of muscular energy man is hopelessly outclassed; as an intelligent supervisor and director he is just beginning to come into his inheritance. In these directions he has no competition nor limit to his value.

Aims and Responsibilities

"Muscular energy no longer counts for much. The world's energy comes from engines, and any man who develops a tool or machine to do work formerly done by men is adding to the number of tireless slaves who serve first the inventor and then all humanity."

In the 25 years since those words were written, a whole new generation of business managers began as novices and have now become senior executives. All have been influenced either directly through study or forced indirectly by competition to observe and practice, at least in part, the principles, the ideals, the philosophy, to which this great movement gave expression. What has been the resulting contribution to humanity?

Before the aims and responsibilities of modern industrial management can be defined so that they are understandable to a critical public, the accomplishments of this past quarter-century should be briefly touched upon. Scientific management must be interpreted in terms of its contributions to improving the lot of the common man, to providing an increased well-being for the ordinary wage earner and his family. Only as the public understands the significance of what industry has contributed to the nation's growth and progress can the public be expected to go forward with industry to obtain greater benefits in the future.

Let me point out a few of the milestones that were passed between the years 1900 and 1930. In that period the population of the United States increased by 51 million people. Of this increase less than 4 million persons were absorbed in agriculture. The remaining 47 million people were dependent for their livelihood upon industry and allied occupations.

In these three decades, the output of American factories increased from 11 billion dollars' worth of manufactured goods per annum to more than 70 billion dollars' worth of goods. As against a population growth of 70 per cent in a generation the volume of manufactured goods multiplied by over 500 per cent, and in quality by perhaps 1,000 per cent!

Millions of New Jobs

In 30 years, nearly 20 million new jobs for the people of the nation were created in industry, business, trade, and other non-agricultural activities, while during the same period employment in agriculture remained relatively constant, fluctuating at above 10 million workers.

While industry was affording support for over 47 million additional people, it was also raising the national income from 16 billion dollars to 80 billion dollars. It was increasing the national wealth from 88 billion dollars to 362 billion dollars. While the population was increasing by 70 per cent, the number of wage earners in manufacturing industry increased by 90 per cent, and the wages paid in manufacturing increased by more than 500 per cent.

Nowhere, in the history of man, can such a record of achievement in so short a span of years be duplicated. These accomplishments did not just "happen." They were the product, not of government, but of a free people, applying to the tasks at hand limitless energy and resourcefulness. They

(Continued on page 124)

THE CREED OF MANAGEMENT

We whose responsibility it is to supply the needs of the public for goods and services, and who recognize our obligations to stockholders and employees, believe:

1.

That we should constantly seek to provide better values at lower costs so that more of our people can enjoy more of the world's goods.

2.

That we should strive to develop the efficiency of industry so as to earn a fair return for the investing public and provide the highest possible reward for the productivity of labor.

3.

That we should stimulate the genius of science and utilize the methods of research to improve old products and create new ones so as consistently to provide new fields of employment for the present and the coming generations.

4.

That management should encourage fair trade practices in business which, whether effected by competition or cooperation, will be so shaped as to be for the best interest of our customers and of society as a whole.

5.

That it is management's duty to be alert to its own shortcomings, to the need for improvement, and to new requirements of society, while always recognizing the responsibility of its trusteeship.

6.

That business in this country has never been what it could be and never what it yet will be.

7.

That Business, Labor, Government, and Agriculture working hand in hand can provide jobs and the opportunity for all to work for security without loss of our liberty and rights as free men.

LEVERHULME WHITE WATT ROBERTSON

Wide World Blank & Stoller

SOCIAL AND ECONOMIC

High lights from selected papers presented by American and foreign delegates at general sessions of Seventh International Management Congress, Washington, September 19-23

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Management's Responsibilities to Society

A. W. ROBERTSON
Chairman, Westinghouse Electric & Manufacturing Company

MANAGEMENT has a great responsibility to furnish as regular and remunerative employment as it is possible to do. Under modern conditions, the average employee hopes and expects to work for a good organization all his life. He marries, buys a home, and makes commitments for the future, all based on his expectations of continuous employment. This is a perfectly natural thing to do, and management must recognize that it has the responsibility to meet the expectations of its employees, if at all possible.

In the past, management has paid scant heed to the problem of furnishing yearly employment. It has expected labor to share the ups and downs of business. If times were bad, labor was unemployed. In a degree, this cannot be avoided. But management, by careful planning, may be able to smooth out, to an appreciable extent, the ups and downs of labor.

Management has been guilty of a day-to-day existence, which magnifies the plight of labor. If management holds out the hope of employment today, it must not shatter that hope tomorrow. Management should be able to plan its work so that improvements, major repairs, and expansion are done in periods of depression when labor might otherwise be unemployed. This means that private enterprise must have sufficient funds to carry it through depressions with confidence. Government must assist management in this laudable undertaking and should be interested in assisting it to maintain a sound financial condition rather than weakening it by unwise taxation. . . .

The collateral responsibilities of management are many. Large factories and mass production lead to congested living conditions and the inevitable lowering of health and morals. Management is not directly responsible for social conditions, which are the indirect result of its factories and production methods, but it must accept a fair share of the responsibility for these indirect results. . . .

Just as it has long since accepted the responsibility of securing safe and healthful surroundings in which men work, it must now accept the responsibility of helping employees secure safe and healthful surroundings in which to live.

Labor's Aims and Responsibilities

ROBERT J. WATT
American Workers' Delegate, International Labor Organization

AMERICAN LABOR today wants to be recognized as the partner of capital in production, as a customer of capital in distribution, as the majority voice in a political democracy, and as the substantial center of our community life. Labor objects to being figured in just as an operating cost which must be squeezed down as low as possible . . . it is tough for Labor as a wage earner, and it is tough for industry as far as sales to wage earners are concerned. . .

So Labor's aim is to win higher wages. We believe that the machine should be a source of profit to the worker as well as to the owner. Higher wages per unit of production seem to us essential. . .

The aim of Labor is to organize the great majority of all wage earners into a united and vigorous organization through units appropriate for the best representation of the workers in the individual craft or industry.

Such an organization will involve heavy responsibilities, of course, but those responsibilities must be the moral discipline of self-control. . .

My message to management on the sub-

FLANDERS KNAUTH LINK COMPTON

Blank & Stoller Blackstone Studios, Inc.

ASPECTS OF MANAGEMENT

ject of labor union responsibility is this: You can have discipline and responsibility within labor unions as soon as you stop waging war against labor unions and give your workers a chance to develop their own patterns of union discipline and responsibility. . .

Management's interests in the face of the world problems of today should be parallel with Labor's . . . it is the duty of all decent people to find a basis for friendly agreement, for real cooperation toward a happier and healthier community. Civilization advances only by progress and freedom of the intellect and conscience of all the people, whether they sit in the executive's armchair or sweat in the foundry. And in America we all want to go forward and are glad to go forward together.

The Continuance of Free Enterprise

A. Basch
General Manager, United Chemical & Metallurgical Works, Prague

IF SOCIAL POLICY forgets, as is now the case, that its highest aim must be to raise the standard of living of the working people, and that this aim can only be reached by an increase of production and not by a new distribution of income; and if this social policy in consequence hinders the activity of enterprise and private initiative, then the direct opposite—a lowered standard of living—is obtained. . . .

We know from history, as well as from the present complicated economies, that regulation of trade by an authoritative regime brings about a static economy and a lowered living standard. On the other hand, it is clear that there are cases where, for example, an industry has to be reorganized temporarily with the help of the State, and where it is necessary to make changes in foreign trade policy. But in our opinion these are steps which should only be taken for a short time, with a view to assist the economy without affecting its structure. If one wishes to balance technical progress and economic exploitation, provision must be made in the economy for as much initiative and free development as is granted to technical science. . . .

Free-enterprise economy means creating forces on which all technical progress is based. It is only necessary to remove the political, social, and other obstacles that stand in the way of such technical progress. Further regulation, further systematization of economy, will only bring further difficulties, tensions, waste of capital, danger of war, etc., whereas a return to economic sense, to the economic laws now so frequently denied, to private initiative—a return to these things, with the simultaneous assistance of the State and of autonomous corporations, will bring about a situation tending toward peace and will be instrumental in re-establishing balance in world trade, with an attendant rise in the standard of living.

The Public's Concern in Industrial Harmony

William Allen White
Editor, "The Emporia Gazette," Emporia, Kansas

SOME TANGLES cannot be unsnarled by a count of noses. The minute we turn to government we turn finally to the ballot box. Alas, the ballot box has definite limitations. Men can solve large questions of right and wrong with the ballot. They can choose, if they have time and information, men who are reasonably honest and fairly intelligent. But industrial problems require delicate instruments. Industrial justice calls for rather erudite information and rather special judgments. If these problems enter government too closely and are directly related to the ballot box, the solution of the pending problem is bungled, and democracy is menaced.

So far as possible this justice between

the forces of capital and labor must be settled outside party politics. Wherever it is obviously necessary, it may be wise for the consuming public to demand that certain branches of American business put themselves through the wringer, reduce their capitalization, even writing off much of the bonded debt of these distressed industries. If any American industrial owner who is patently overcapitalized, does not voluntarily reduce his fixed charges, the government will do it with taxes.

Here is the bald problem: Shall American capitalists go bankrupt paying taxes to support the unemployed? Or shall we wipe out some of our fixed charges and give the idle workers jobs? Whether taxes or wages, it comes out of the same pocket. We are reaching a dangerous point. The rising flood of unemployment is slowly but inexorably eating into the income of the middle class. We cannot go on increasing the number of idle men who cannot be employed in certain industries—not many, but conspicuous as they are now capitalized.

Sooner or later—and I fear much sooner than we realize—we shall reach a point in the rising tide of the fixed charges in government where we shall not be able to collect taxes to pay those fixed charges of government. Then the government will man the wringer and God help the investor. No matter who turns the crank, Republican or Democrat, Fascist or Communist, the result will be the same. For it will have to be the same. With wages or taxes these idle workers must be fed. If the workers draw wages, they will be free men. If they live on taxes, the government that feeds the unemployed will control their votes. It's human nature.

Surely in private industry on this continent there is an adequate margin of operator's profit wide enough to keep American commerce afloat as a going concern, allowing for decent earnings, for living wages, for attractive prices to the consumer that will move the goods. And surely again America can produce brains in a free industry to solve this terrible problem somewhat outside of politics without too much government aid or control.

Reshaping Distribution to Modern Economy

OSWALD W. KNAUTH
President, Associated Dry Goods Corporation, New York

VAST CHANGES have rendered the task of distribution peculiarly difficult and risky. For it is the distributors who attempt to gage, not merely the desire of the public for the articles which industry is capable of producing, but the effective demand for them—and that's a very different story, for desire is not always accompanied by effective demand.

There is no single method of distributing articles towards which we are tending and which will prove itself more economical and superior to the variety of methods now in practice. All of the various methods now in existence serve a useful purpose and are here to stay.

Their relative importance, however, will undergo changes. The question is what the unforseeable changes in our social life will require, for on these depend the future processes of distribution. Certain trends seem pretty clear. We are moving out of large cities into smaller communities. We have fewer large fortunes, whatever may be the status of medium-sized incomes. Wages are tending towards a larger share of the national income than in the past. Government income taken from the community through taxes and distributed to officials in relatively small fixed amounts is on the increase.

All of this will mean a decreased importance of the specialty store; an increase in chain distribution, unless hampering legislation increases with artificial restrictions; a lessening of direct-by-mail, either from factory or from a distribution center; an increase in the importance of larger department stores at central points having a wide selection of medium-priced goods; a lessening of the importance of location; a decreasing demand for service.

Whichever of these methods becomes more or less important, the cost of distributing articles will remain. It is an expensive process . . . it entails extensive research . . . entails a high rate of obsolescence . . . requires the maintenance of warehouses, display rooms, and places of business. Service must be ever ready and ever alert. Delivery in crowded cities is slow and expensive—in less populous areas it requires long trips to isolated dwellings. These costs could be lessened with less service; and many successful distributors supply varying degrees of service. But in any case they are high. For the value of an article is as much dependent on its being in the right place as it is on having the qualities needed.

Methods of Industrial Conciliation and Arbitration in Great Britain

R. LLOYD ROBERTS
Chief Labor Officer, Imperial Chemical Industries, Ltd., London

APART from our general dislike of compulsion, our objection to state intervention in the field of industrial relations is based on a principle to which we attach the greatest importance. State intervention in any country is only a nice way of saying political intervention, and we believe it would be highly prejudicial to the national interests if questions of hours of work, wages, etc., were to be caught up in the maelstrom of party politics and settlements were effected in pursuance of some pet political theory instead of in conformity with the ascertained economic facts of the situation.

We like to keep industrial problems to the calm, unimpassioned atmosphere of the business conference room, where they can be subjected to the necessary reasoned analysis and discussion, rather than let them drift on to the political hustings.

After all, a country's prosperity is built on its business community—employers and employed—and in our view that community should be left to settle its problems itself, without regard to the political complexion of the government of the day, provided always that the greater interests of the nation as a whole are not injured thereby.

It is in accordance with that declaration of faith that our machinery of industrial conciliation and arbitration has been evolved on a voluntary basis.

[For more complete details of British methods, see "A Case in British Labor Relations," R. Lloyd Roberts, November, 1937; also "Britain's Way with Labor," E. J. Mehren, August, 1938—ED.]

Coordination of Production and Distribution

NILS A. STERNER
*Assistant General Manager, Telefonaktiebolaget L M. Ericsson, Stockholm**

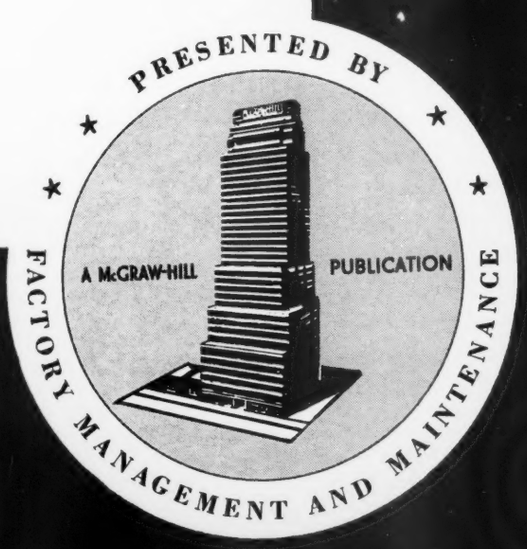
PRODUCTION is no self-sufficient activity. Goods are made to be sold, and production must therefore keep pace with the wishes of the consumer with reference to design, quality, and utility. This means research and development. Production has the natural inclination to resist change, whereas distribution is more disposed to follow the wishes of

(*Continued on page* 134)

* L. M. Ericsson Telephone Company.

PUBLIC RELATIONS for INDUSTRY

With Special Reference to the Manufacturing Industries



An Editorial Service to Meet

INDUSTRY'S MAJOR PROBLEM

To the readers of FACTORY MANAGEMENT and MAINTENANCE

THERE IS NO DOUBT that today the American people are taking a keener, more critical interest in the conduct of business than ever before. And when I say critical, I mean exactly that. During recent years most of them have suffered loss, of either jobs or savings, and under such circumstances men are prone to accept without serious question any scapegoat that appears plausible. In the confusion of fears and resentments, they seem to have concluded that short-sighted and selfish business management is chiefly responsible for their misfortune.

However mistaken and unfair such conclusions may be, management cannot ignore them. It must recognize that, in the long run, the opinions of men are the result of experience, of what happens to them each day, much more than of what they are told.

Progressive management has already faced that fact; has already begun to think and work beyond the technicalities of production and distribution that once absorbed most of its energies. It sees more clearly and deals more proficiently with its human responsibilities. It is learning to reconcile the economic success of the industrial unit with the social welfare of worker and community.

Presently, every business—the small retailer as well as the large manufacturer—must learn how to interpret more convincingly to its own public the social as well as the economic benefits of its policies and accomplishments. Only as each business satisfies the newly aroused and critical interest of people in its affairs will it be able to disarm those who trade on the human tendency to blame our troubles on someone else. Yes, if business as a whole is to win a favorable public opinion, each and every business must act to improve its own public relations.

The readers of this journal, and of other business publications, compose, we believe, a group that can achieve for American business a sound and lasting solution of this vital problem. They alone are in position to shape the working conditions of 21 million employees. In distributing and commercial organizations, they alone can mold the attitude of those other millions who compose the various "publics" to which all business must be responsible.

Heretofore, the function of business papers has been to exchange successful experience; to dig up and disseminate practical facts for the use of their readers, serving primarily the technical and merchandising needs of business. But this matter of human relations has now become of equal importance, for good industrial and public relations, it has been found, reduces corporate losses, removes fear and suspicion, promotes operating efficiencies in both production and sales. A better knowledge of public relations technique is, therefore, quite properly essential for men in, or moving into, positions of greater executive responsibility.

So, beginning with this insert, each McGraw-Hill publication sets out to strengthen its editorial service in the important domain of Public Relations. I hope that the million readers of McGraw-Hill's business papers will get much real and practical help toward building better relationships between their own businesses and their employees, their customers, and the communities in which they must carry on.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

Why a Public Relations Program

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In less than two generations the United States has changed from an agricultural to an industrial nation. Living standards and efficiencies at once the despair and envy of other countries have been created. Foreign delegations still flock to our shores to study our methods so that they may use them as patterns for their own organizations. Yet here at home today these methods and the systems responsible for them are under increasing attack.

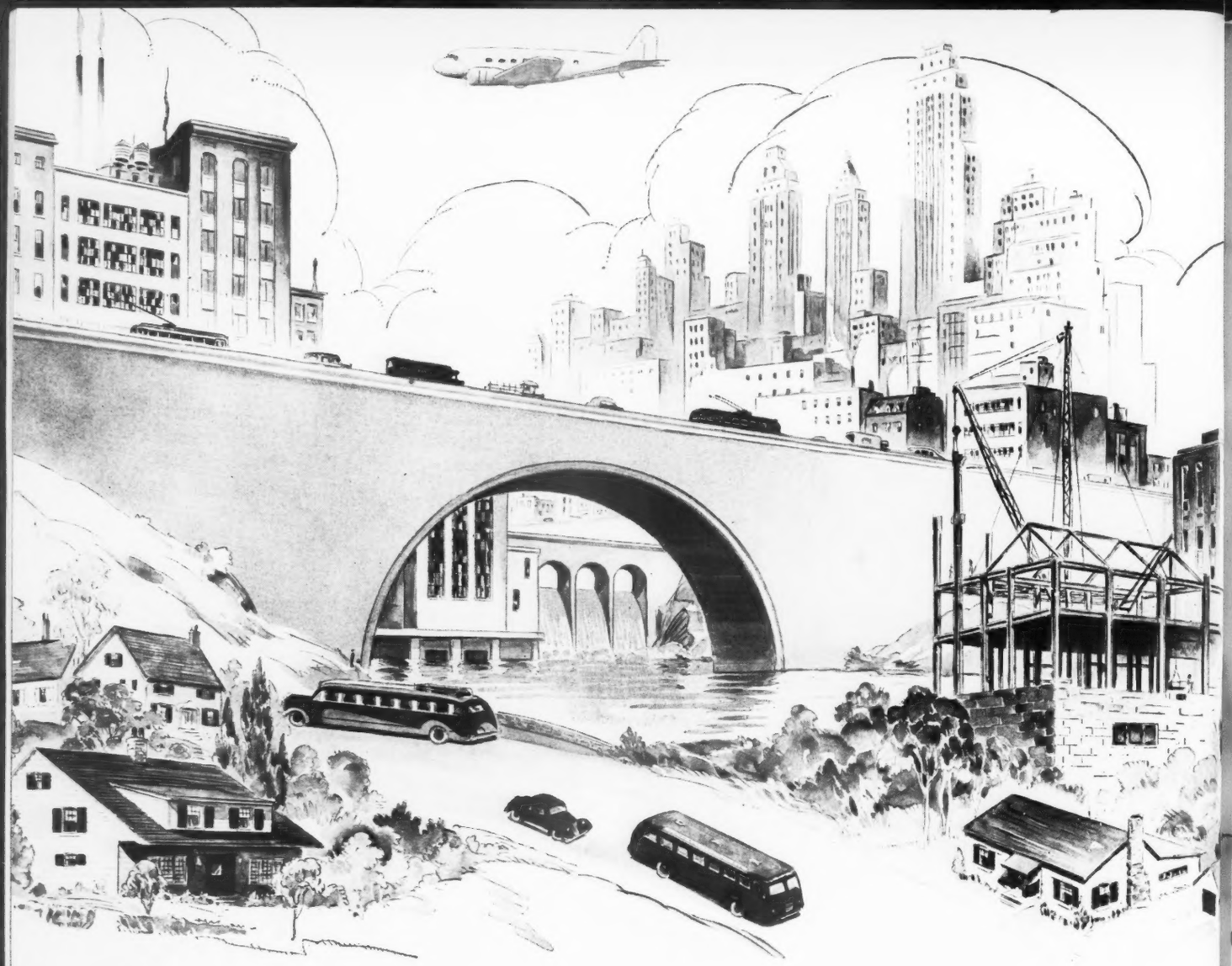
Since every person employed in productive enterprise is a part of American industry, these attacks imperil the livelihood of nearly 40 million workers and their dependents. The newest addition to the payroll has as much at stake as, if not more than, the veteran business executive. That also is true of particular industries which at present may not be under direct fire. All industry is so interrelated and interdependent that even the seemingly immune enterprise must suffer when the legitimate activities and the buying power of their customers, or the customers of their customers, are curtailed.

Ironically enough, public acquiescence in many of the current attacks is an indirect recognition of the satisfactory manner in which our industrial system normally functions. Reasonable opportunities for the employment of those ambitious to put their mental or physical talents to work, and continually rising standards of living have come to be widely accepted as a matter of course. Any unfavorable change in these conditions leaves the general public surprised, confused, and resentful. Such reactions as these make it easy for pressure groups to unloose destructive propaganda which further heightens resentments and breeds new misconceptions.

These misconceptions take many forms shaped by the experience, the inexperience, or the special interests of the critics. To one it appears that business can't manage itself and must be owned and managed by the Government. Another believes that employees are underpaid, or that stockholders and executives are overpaid. To others corporate surpluses are too high. Many have convinced themselves that power and machines have reduced employment opportunities, and that industry can raise wages and reduce prices while costs go up.

Several misconceptions are based on faulty generalizations. Because a few companies have been remarkably successful, it is argued that all could make money. Because some corporations have been ruthless, all corporations, it is contended, will stoop to unethical conduct to gain their ends. This is like saying: John Smith killed Bill Brown; John Smith is auburn-thatched; all redheads, therefore, are murderers. Unfortunately, those who would indict all business for the crimes of a few are more subtle in their approach and so create an impression not in accord with the facts.

To put it bluntly, American industry, once so highly praised for its contributions to the national well-being, is now on the spot. Prevailing misconceptions of how business operates and what it does, have made a field day for those who propose to hamstring or destroy private initiative and individual opportunity. These proposals run a broad gamut. They include public ownership, increasing and rigid



federal control at the expense of local autonomy, ill-conceived legislation on hours and wages, labor dictatorships, and confiscatory taxes on thrift and employment security.

While the man in the street may be criticized for his willingness to swallow these nostrums, he is not wholly to blame. Industry, too, has been at fault, in assuming either that he was fully informed on those phases of its operations which are properly a matter of public interest, or that a healthy curiosity should be discouraged. Misconceptions multiply where the facts are hidden.

THE TRAGEDY of the situation lies in the fact that it might easily have been avoided. In the simple days of local and localized industry, everybody connected with a particular enterprise knew everybody else connected with it, and the details of its operations were an open book. The boss and the employees were neighbors; the customers, for the most part, fellow-townsmen. Outside purchases were limited largely to those products that the local community neither manufactured nor raised. Competition in the modern sense was practically non-existent.

As industry developed and enlarged its field of operations, much of this early intimate personal touch was lost. The small enterprise grew bigger. In some cases combinations took in the local business, and financial control passed out of the community. The local industry that still retained its identity was busy meeting increased competition and seeking to expand its distribution. Little attention was paid to changing conditions that were fostering misconceptions about the personal relations of the business. Bit by bit the close acquaintance and familiarity of the early days disappeared.

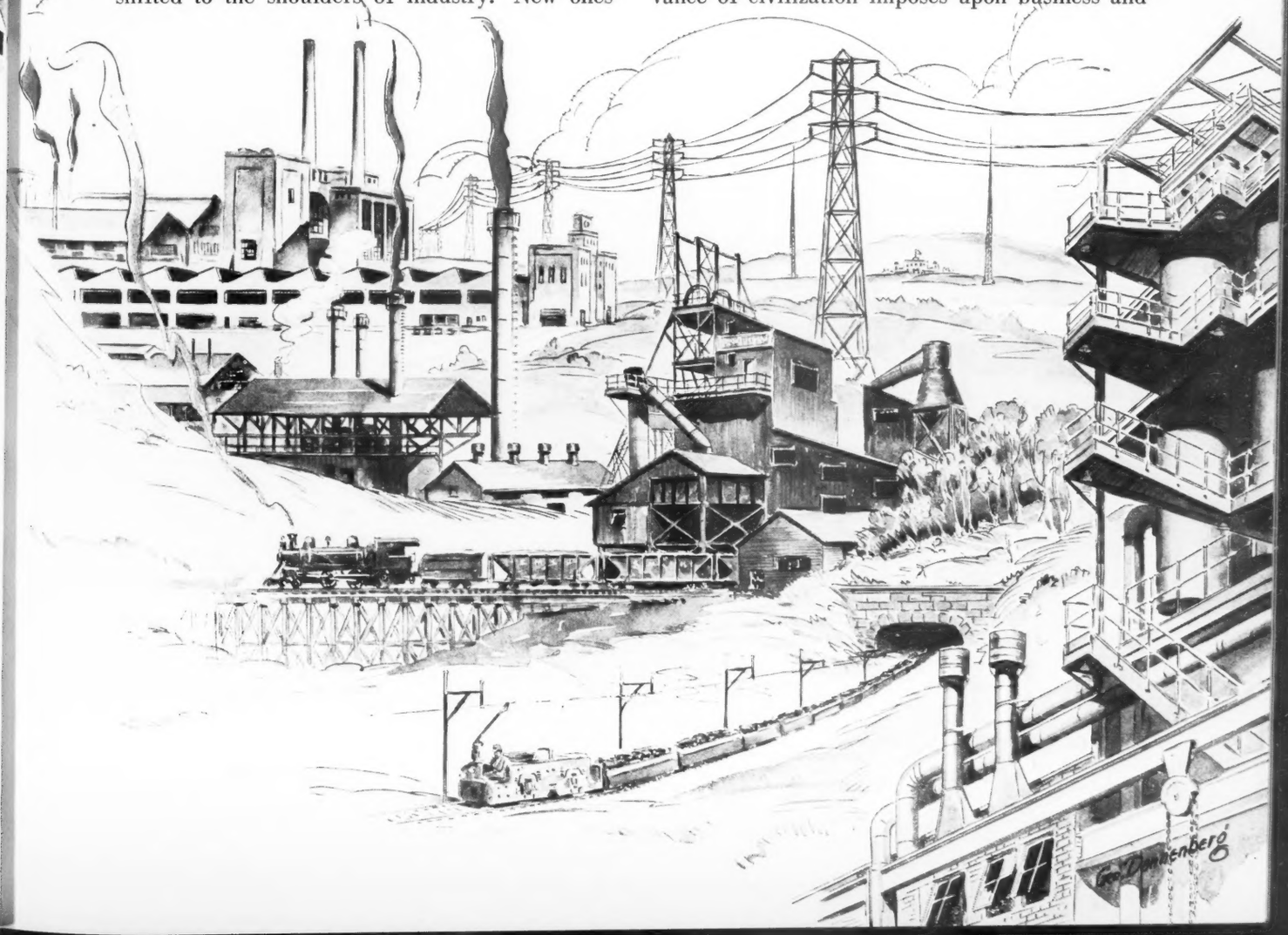
Common understanding of these things also was impeded by the greater variety of occupations as industry expanded. Each man's job became so highly specialized that the old feeling of common partnership in a joint undertaking frequently was buried in an exaggerated feeling of

the relative importance of his own work. This made it easy for each occupational group to get the idea that its contribution to the undertaking alone was essential and that many of the other groups were parasitic or, at best, unimportant.

SUCH MISTAKEN BELIEFS are the exclusive property of no particular group. "Goods are valueless until sold," chants the sales staff; "without us the wheels of industry would cease to turn." "The wheels would turn much faster," growls the production department, "if we didn't have so many lame-brains drawing fat salaries as salesmen." Under the cold glance of both groups, the clerical force heatedly inquires: "How long do you think this business would last if we didn't keep the cost records, send out bills, and collect the money for pay checks?" Some executives and engineers, too, have been known to forget that their plans cannot be carried out without the cooperation of other groups.

Possibly the greatest single cause of misunderstanding and friction has been fuzzy thinking on social responsibilities. Many of the responsibilities which rested on the individual or the state in our fathers' and grandfathers' days have been shifted to the shoulders of industry. New ones constantly are added or proposed—often before industry has had time to adjust itself to those that have gone before. Some of these responsibilities affect employee relations; others involve customer relations. The worker, for example, no longer is completely defenseless against the occupational hazards of his employment. "Let the buyer beware" no longer is considered smart merchandising. Many of the changes now embodied in the laws were anticipated by industry itself. Opposition—valid or otherwise—to social legislation, however, has been used to damn business in the public eye.

Fortunately, the barriers to good will and common understanding can be broken down. The process is a simple one. It consists chiefly in maintaining good policies in human relationships and in keeping all interested people—employees, stockholders and their neighbors, customers, and the general public—informed. It means telling them in plain terms what revenue is received and where it comes from, what revenue is paid out and who gets it, how an industry serves the individual, the community, and other industries. Finally, it includes the acceptance of the social responsibilities that the advance of civilization imposes upon business and



industry. Add all these things together and you have public relations.

Most employers are willing to accept their social responsibilities, but they are inexpert in making that acceptance articulate. Too many employers have failed to make clear their policies, their practices, and their purposes as they relate to fair dealing with employees, investors, and the general public. Their intentions have been good, but they have cloaked them with a veil of secrecy and made a mystery out of simplicity. As a result the uninformed have been given a royal opportunity to exercise their imagination. And they have done it!

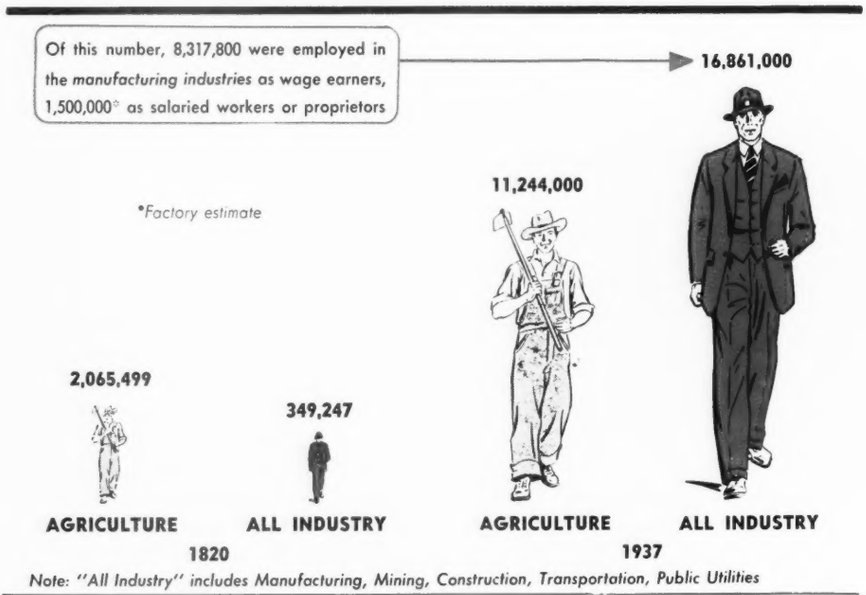
Public relations is a comparatively new activity for most business enterprises and involves a technique which too many have not yet learned. Obviously, the first place for each company to start is within its own organization. This is the "inside job" that builds a company's good name among its own family and lays the firm foundation for building public confidence and favor. As one exponent of the art phrases it: "Industry's public relations cannot be one thing and its private actions and policies something else. The two must be in complete accord."

The inside job should present no real difficulties to fair-minded employers. Most workers have a normal predisposition to view in a favorable light the organization in which they earn their livelihood. Most companies endeavor to conduct their operations so as to justify that favorable attitude. But too few of them are adept at dramatizing the facts that furnish a substantial basis for maintaining employee good will. So, where misunderstanding and suspicion born of ignorance exist, time may be required to break down the barriers that have grown up.

The task of telling this inside job to the outside world, however, will not be easy, for two reasons. First, it has been so long neglected that the backlog of misunderstanding is large. Second, public relations involves attitudes as well as actions, a viewpoint as well as an organization. Public relations is not a commodity that can be purchased like a car of coal or a bolt of silk; neither can it be sold by "canned" material. Each program to establish sound public relations must be individualized and indisputably stamped with the personality of the company promoting it. *And the deed must always back the word!*

But the task is worth the effort. For, with the inside job right, a properly conceived and intelligently executed public relations program offers business the means of counteracting unjust public suspicion, unfair political attack, and unwarranted outside dictation. The need is urgent.

Basic Data Which Industry Can Use Are Given in the Nine Charts That Follow



Note: "All Industry" includes Manufacturing, Mining, Construction, Transportation, Public Utilities

In little more than 100 years, while population has increased 13½ times, jobs in industry have increased 48 times. Jobs in agriculture have increased 5 1/2 times

Sources: U. S. Bureau of the Census; National Industrial Conference Board; U. S. Department of Labor

A Program for Public Relations

ONCE a company has decided to develop the too neglected technique of public relations, it is possible to lay down a fairly definite program and to follow it. The basic elements are nearly identical, no matter what the product of the manufacturing concern. Essentially it is all a matter of maintaining a contented and effective organization and a good name. The problem resolves itself into an inside job and an outside job.

The inside, or industrial relations, job must be done well before the outside, or public relations, job can be done properly.

The Inside Job of the Individual Company

In the development of good industrial relations within the organization, an orderly procedure generally accepted may be set down in six steps:

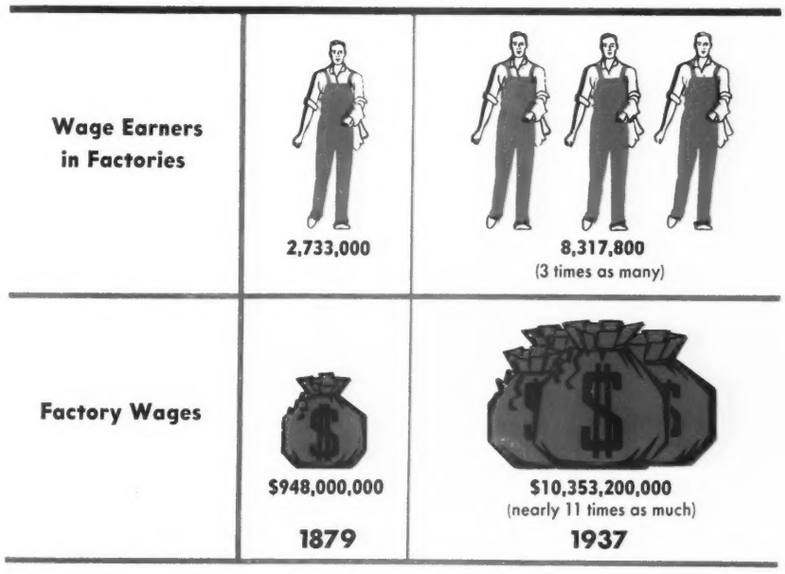
1. Set Up a Leader. This work needs the leadership of an able executive with knowledge of the business and skilled in guiding human relations. He should report to the chief executive.

2. Clarify Organization. Uncertainty means an uneasy personnel inclined toward political maneuvering. The organization of the company should be clearly defined, so that the authority and responsibility of individuals may be known to all. In most cases, this procedure calls for more than a simple organization chart. A manual may be necessary. Whatever is done should be adequate to make specific the line of authority and the functions of all officials.

3. Determine Personnel Policies. A statement should be formulated by the top executives, aided by representatives of all the management groups. If satisfactory relations have been established, the statement should be submitted to the employee representatives. Once adopted, the policies should be made known to all employees of the company.

Policy statements should be definite in such matters as wages, working hours, overtime, promotions, layoffs, vacations, sickness relief, safety, training and education, profit-sharing, collective bargaining.

4. Improve Personnel Efficiencies. Strengthen those influences within the organization that increase the efficiency of the working force, the purpose being to advance the opportunity for the individual and the company through lower production



In 1937 (latest data available) there were 3 times as many factory jobs as in 1879 (about 60 years ago). Wage earners received nearly 11 times as many dollars

Sources: U. S. Bureau of the Census; U. S. Department of Labor

costs, better service to customers, and improvements in the quality of product.

As a basis for carrying out a program looking toward increasing the efficiency of the working force, it is necessary to establish certain basic policies relating to:

1. Payment of prevailing wage and salary scales.

2. Evaluation of jobs and setting-up of uniform scales of pay for equal grades of work in the company.

3. Establishment of pay differentials, having due regard for responsibilities, requirements in skill, mentality, working conditions, physical application.

4. Establishment of financial incentives also, where possible.

5. Setting-up of positive procedures by which all changes in rates of pay are fully explained to the employees concerned.

5. Assure the Well-Being of Employees. Look after the physical and mental well-being of employees by providing safe and sanitary working conditions and the plant services necessary for comfort. This means adequate ventilation, heating, cooling, lighting, elimination of noise, and, going a step further, suitable provision for rest, meal times, and recreation.

The stabilizing of employment and the establishment of protection against unemployment, sickness, old age, and death have far-reaching influence upon both the physical and mental welfare of employees. So has assistance to deserving individuals in their problems of savings and housing.

6. Train and Educate. A suitable program should be developed for advancing men and women in the organization and as citizens of the community.

These six steps are designed to create and maintain on the part of employees a feeling of confidence in the management and satisfaction with their work and their future. This is the most important part of the "inside job" of public relations.

Not only is it necessary to *do* the inside job. It is equally essential to let employees know that it is being done. There are several vehicles, including meetings, employee magazines, bulletins, and "reports to employees and stockholders." Considerable stress is placed on the last-named in the following part of this section. The vehicles chosen must depend upon the types of employees and managers in specific plants.

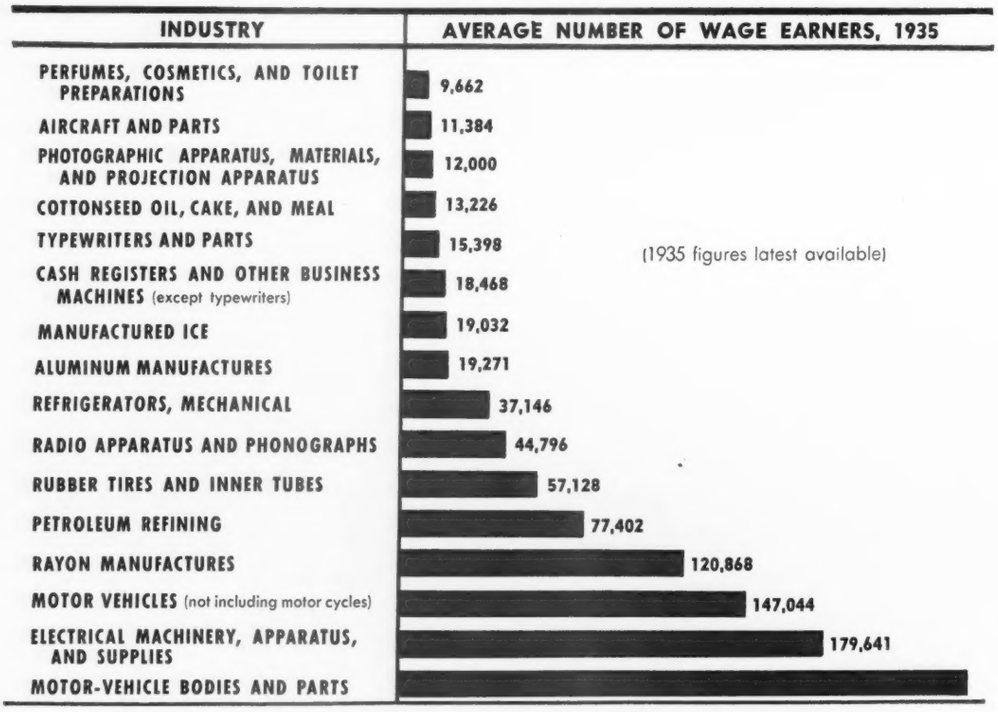
The Outside Job of the Individual Company

When a good job of industrial relations has been done within the organization, the most important step already has been taken toward building up good will outside. The company is now in position to tell its customers and the public, not what it aspires or pretends to be, but what it is and how much it contributes to the public welfare.

For Customers and Prospects there are many obvious facts about a company that are of interest:

1. Manufacturers of equipment and producers of raw materials that touch the lives of people only indirectly can show how their products raise the general standard of living.

2. Companies that sell their products or services directly to people can



During the period 1879 to 1937, 16 new industries created more than a million new jobs in the making of equipment and products that we cannot now imagine living without

Source: U. S. Bureau of the Census

interpret the resulting social and economic benefits in terms of human well-being.

3. Both types of organization can publicize interesting facts and figures about themselves, their policies, and their products.

4. Through trade and industrial associations, local and national, all types of business can join in promotional programs for the information and education of the public.

In the Community where the company is located, people judge the company by the things they are told. They may get their information from individuals or groups who are not parts of the organization and who are working for selfish ends. These people may or may not give facts. Or they may get their information from the employees themselves, who are prone to tell the truth as they know it. In promoting community good will, informed employees are an asset to the company that has done the "inside job."

A company can participate actively in building good will in the community by taking progressive steps to publicize facts about itself, making them available promptly, accurately, clearly, and frankly, through the usual media that exist in every community.

The use of this method necessarily involves the taking of an active and constructive part in community affairs. By becoming itself a good citizen and neighbor, a company makes itself known and liked. Here are types of community activities that have been used successfully:

1. Holding "open house" in the plant for visitation by people of the community.

2. Close acquaintance and cooperation with the local press, following a policy of giving the whole truth and nothing but the truth.

3. Taking part in exhibits or expositions of the products of local industries.

4. Joining with other industrial companies in the community to disseminate facts and to create and maintain public good will.

5. Encouraging employees to participate in civic affairs.

6. Discussing company and community affairs with local leaders of thought, such as preachers and teachers.

7. Participating in the operation of a community foremen's club.

8. Circulating factory house organs to interested people outside the organization.

9. Presenting facts before civic organizations, women's clubs, luncheon clubs.

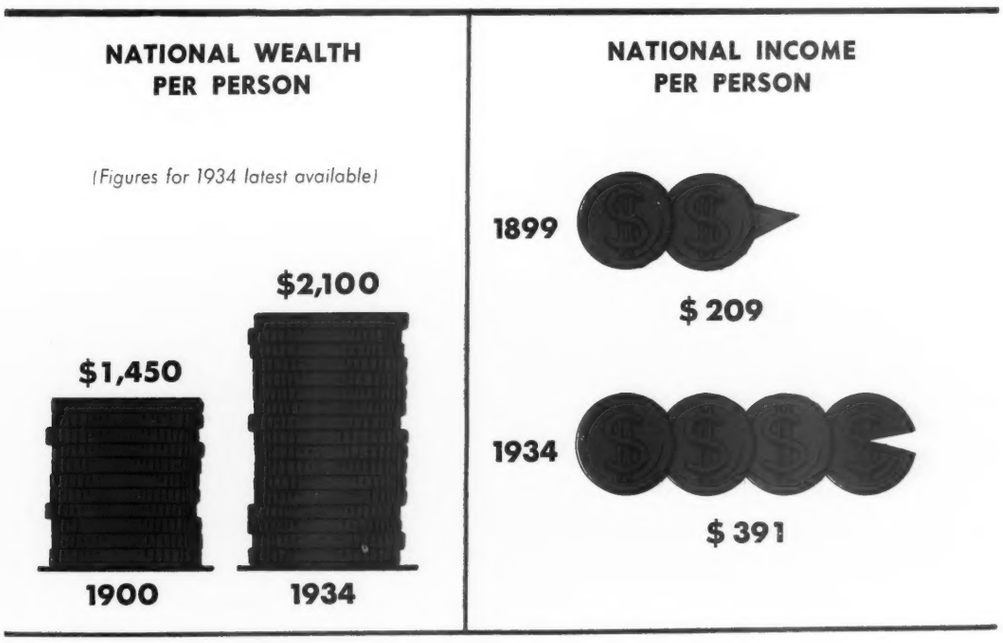
10. Showing plant operations by motion pictures in schools and before other groups.

11. Cooperating with local charities and character-building agencies.

The Company Can Cooperate with Its Industry

By and large, an industry as a whole is represented by its trade association. This representative should, therefore, be able to act as a clearing house for the exchange of the plans and experiences of individual companies in the work of industrial and public relations.

A part of the clearing-house job



National wealth per person was $1,450 in 1900, $2,100 in 1934 (latest figures available). National income in 1899 was $209, in 1934 was $391. ($539 in 1937; $664 in 1929)

Sources: U. S. Bureau of the Census; National Industrial Conference Board

can be the collection of industry-wide statistics, even national statistics about industry, and their presentation to member companies ready for use.

From these activities of the trade association, the individual company is likely to benefit most if it contributes willingly and fully, for their effectiveness will depend upon completeness.

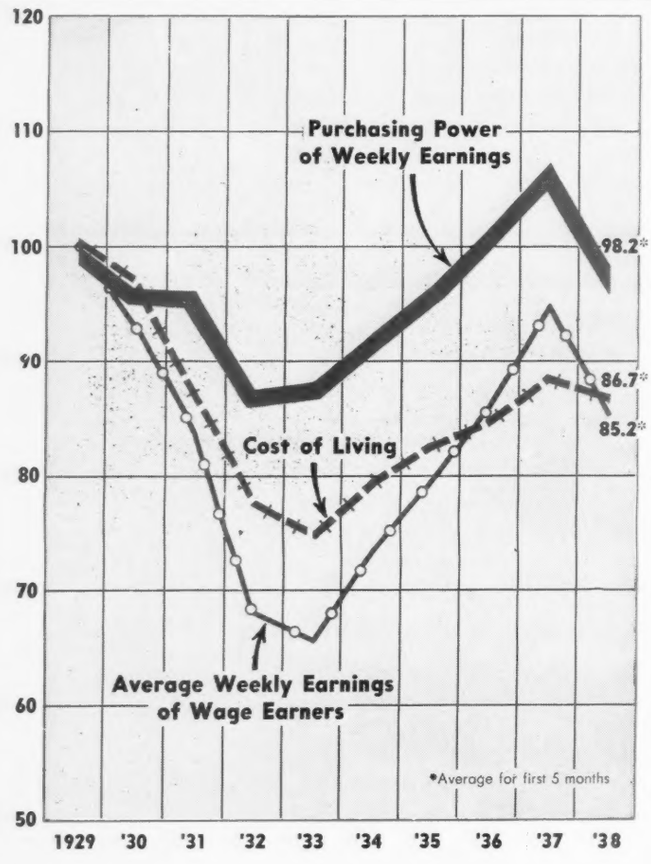
The Public Relations Job of the Community

In addition, there is the public relations job of the community which, carried out jointly by representatives of the individual plants, may promote local good will. Obviously, this group can be effective only as it presents convincing facts about the community's industries.

It will have no standing before the press and public, and its activities may well result in unfavorable rather than favorable regard by the people of the community, unless it sets and enforces standards of membership.

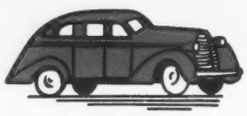
Once this cooperative working group is under way in a community, it has unlimited possibilities for participation in local affairs. One of its most effective weapons is advertising in the local press. It has the opportunity to show that the welfare of the community as a whole and of all the individuals who live there is bound up with the welfare of the industries of the community.

All this is actually part of one program, starting in the plant and working outward. The development of such a program entails much thought and work. It requires a highly specialized technique. A capable man may be available within the organization, but the job is not one for an amateur. In the majority of cases some help must be sought outside. It may be found either by hiring an experienced industrial relations executive or retaining the services of an experienced management consultant with a good record of achievement. It is absolutely vital, of course, that the executives of the company be solidly behind the plan as a permanent function of management.



While wealth and income per person were increasing, wages went up more rapidly than prices, so that employees' incomes purchased more. The incomes rose faster than the cost of living

Sources: National Industrial Conference Board; U. S. Department of Labor



20,000,000 out of 30,000,000 American families owned cars

1937

24,000,000 American families owned radios

1937

64,000,000 life insurance policies held by American people

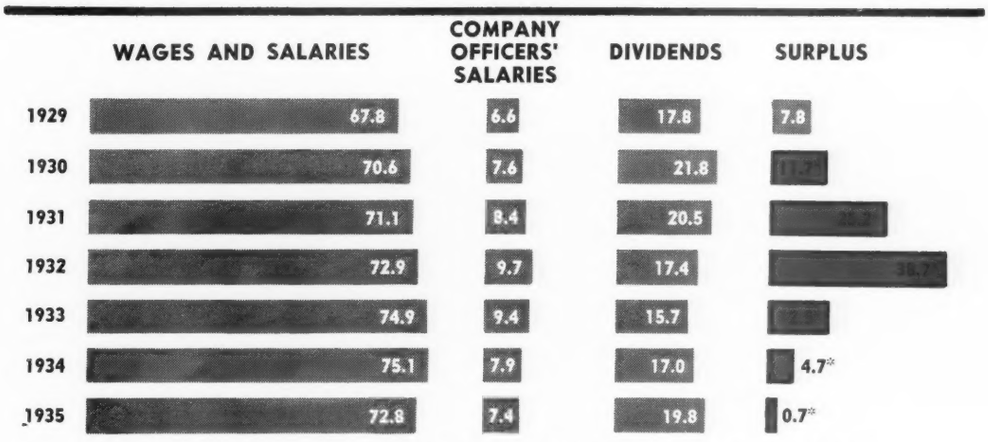
1937

The American people had 44,226,178 savings accounts

1937

Results of increased buying power are shown in the American standard of living as measured, for example, by ownership of automobiles, radios, life insurance policies, savings accounts

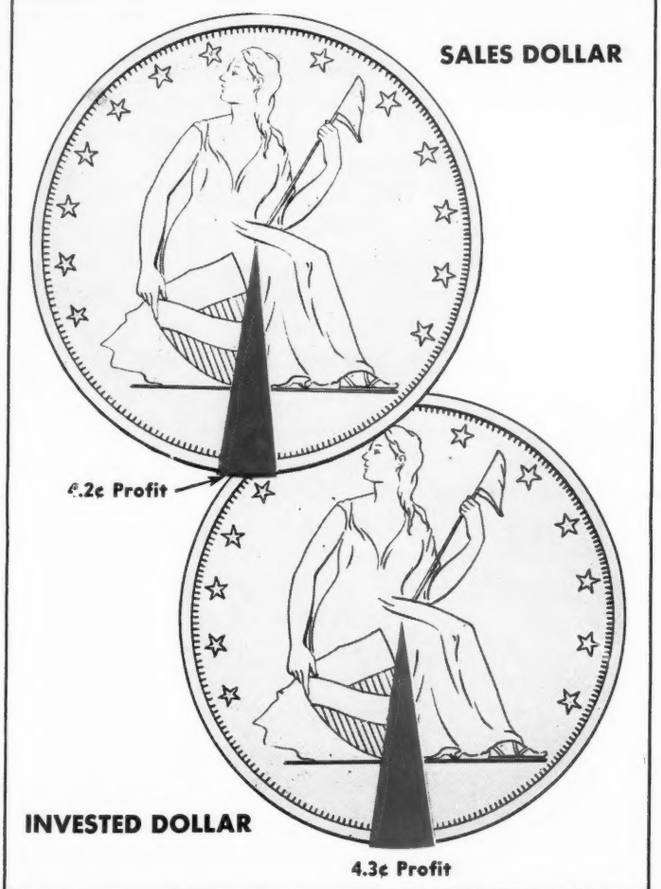
Sources: Automobile Manufacturers Association; Joint Committee on Radio Research; The Annalist, (N. Y. Times); American Bankers Association



*Shows percentage of total expended for wages, salaries, and dividends that had to be withdrawn from surplus

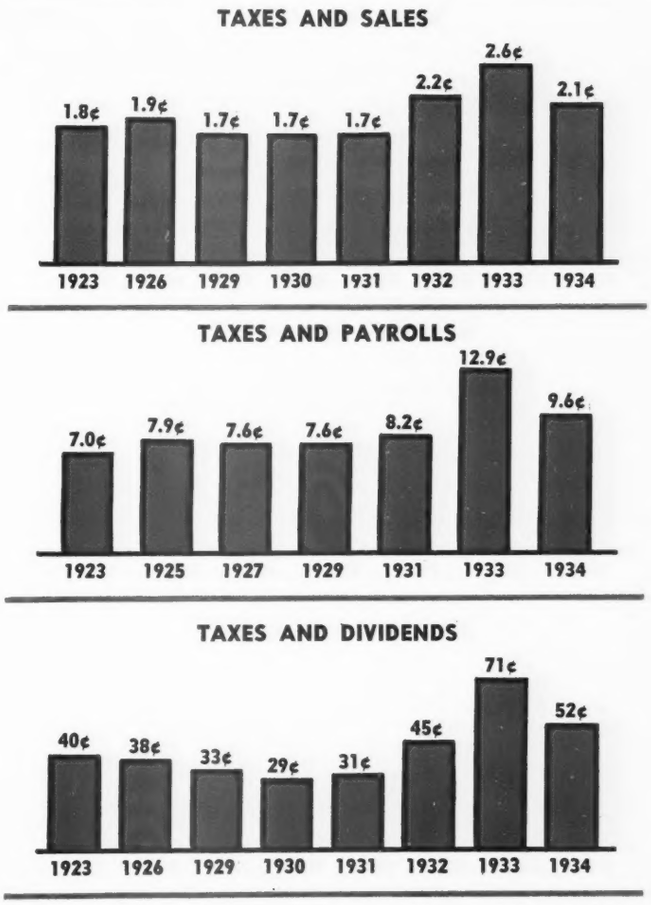
During the historic period 1929-1935, 78.2 per cent of the money taken in by the manufacturing industries went for materials, fuel, transportation, replacement, interest, rent, taxes. The remainder, plus a considerable amount taken from surplus, was expended as shown on the chart

Source: National Industrial Conference Board, using official government figures



During the period 1923-1934 (latest figures available) the average profit in the manufacturing industries was equal to 4.2¢ for each sales dollar, or 4.3¢ for each invested dollar

Source: U. S. Statistics of Income



During the period 1923-1934, factories paid out for federal, state, and local taxes from 1.7¢ to 2.6¢ of each sales dollar. Taxes were as high as 12.9¢ per payroll dollar and 71¢ per dividend dollar

Source: U. S. Statistics of Income

How a Company Can Make Simple Reports to Its Employees

"THE industrial relations job must be done well before the public relations job can be done properly." At the risk of apparent overemphasis this sentence is quoted from our outline of a program for public relations.

With a sincere conviction that the statement is true, we now suggest that a very important part of the industrial relations job is to make known to all employees the facts about their company.

There are many things that employees want to know. They want to know about "employee relations policies" — dealing with things like collective bargaining, hiring, firing, promotions, seniority, rates, hours, absenteeism, sickness, insurance, pensions. Once policies in regard to these matters have been worked out, telling about them is relatively easy.

But they want to know, also, about the company's business and financial matters—how much money the company takes in and who gets that money. These things, too, it is relatively easy to tell about. Each company has to tell them to the income tax collector, and since the figures must be put together, they can, with little added work, be made known to employees, their families, and friends.

Factory, in the three charts that follow, shows the way by making a report for the manufacturing industries as a whole for the period 1929-1935. The figures are taken from records compiled by the federal government from the income tax returns of manufacturing companies.

These charts are so simple that anyone can understand them. Any company can make a set of charts just like them to tell how much money it takes in and how it spends that money.

The same accounting can be given in words and figures. The National Industrial Conference Board has done the job that way in the tables reproduced on page 68.

These tables show, as does our chart on page 67, that during the seven years (1929-1935) the manufacturing industries as a whole paid out $7,555,934,000 more than they took in. This amount could have been taken only from surpluses.

Most of these surpluses were saved prior to the year 1929, the only year of the period when factories as a whole were able to set aside money for rainy days. A word of explanation is necessary, as it well may be in the case of a similar statement by the individual company:

Not *every* company paid out more than it took in each year or during the whole period. Not *every* company paid dividends. However, *some* companies made profits and paid dividends from them. *Some* paid dividends from surpluses. *All* companies paid for materials, fuel, and so on—and *all* paid wages and salaries.

When all the "dids" are added together and all the "did-nots" are substracted from their total the net result shows a withdrawal from surplus by factories as a whole. Some of this money went to pay dividends, some to pay wages and salaries, some to pay management.

In a parallel report by an individual company, there can be no doubt as to profit or loss. The company either did or did not pay out more than it took in.

This kind of statement for the individual manufacturing company plus the same statement for factories as a whole make up a factual report that can be only favorable to industry in its job of public relations.

IN THE PRECEDING PAGES

Why it is necessary to do the public relations job

An outline of the steps to follow, both inside and outside the plant

Basic data that industry can use in public relations

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IN THE FOLLOWING PAGES

A report on the manufacturing industries as to how much income they received; how they spent that income; how much employees, management, and owners got

Suggestions as to how individual industrial plants can make similar reports to their employees in the interest of good public relations

How Much Income Factories Received

HOW MUCH MONEY do the manufacturing industries—or factories—take in, and who gets that money?

Each factory has to give the answers to these questions in making its income tax returns for the government.

The government adds together the similar items in all the returns and puts the totals on record as statistics of the manufacturing industries—or factories.

Factory doesn't know individual company figures. But it does know the figures for the manufacturing plants as a whole. It simply gets them from the government records. In the chart below is shown how much money the factories of the nation took in.

For the factories as a whole, as with the individual factory, there are certain major sources of income.

Every company makes sales of its products. That's why it is in business. As a matter of fact most of its income is received from collections resulting from sales. But every company has some bills it can't collect—they are called "bad debts." So, from total sales, deduct bad debts. The remaining amount is the actual income from sales. It is 95 per cent of the income for factories as a whole.

Some companies invest in the stock of other companies. The dividends from these investments are another part of income. For all factories they represent 1 per cent of the money factories received.

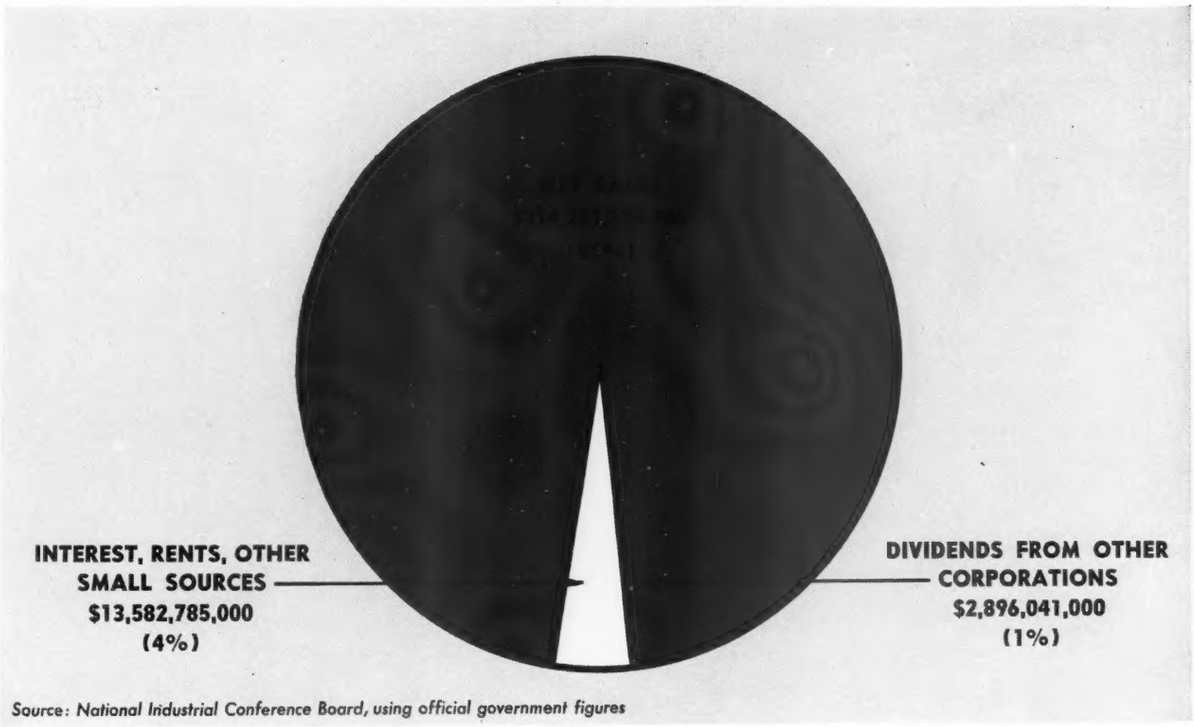
A company is likely to be getting interest on money that it has loaned. It will also receive rent from property that it owns. There are other miscellaneous sources, all small. They account for 4 per cent of the income of factories as a whole.

And there you have it. Add these amounts together and the total is the income of the nation's manufacturing industries—or factories.

For the seven years 1929-1935 this amount was $330,709,960,000.

TOTAL INCOME FOR THE PERIOD 1929-1935 ($330,709,960,000)

Manufacturing Industries



Source: National Industrial Conference Board, using official government figures

What Factories Spent Their Income For

ONCE an employee knows what his company got, he wants to know what was done with it. Certainly he realizes that his company can't get along without materials. And he knows that fuel of some kind has to be bought. He can understand shipping charges (transportation) and he knows that charges for supplies belong in the picture.

These are the main items of expense outside wages and salaries. In the chart they are lumped, and they consist partly of "other costs and expenses." That is the best we can do for factories as a whole. Of course the individual company can do better. It can really itemize, and is well advised to do so. The item "other costs and expenses" should be relatively small if it is not to stimulate undue curiosity.

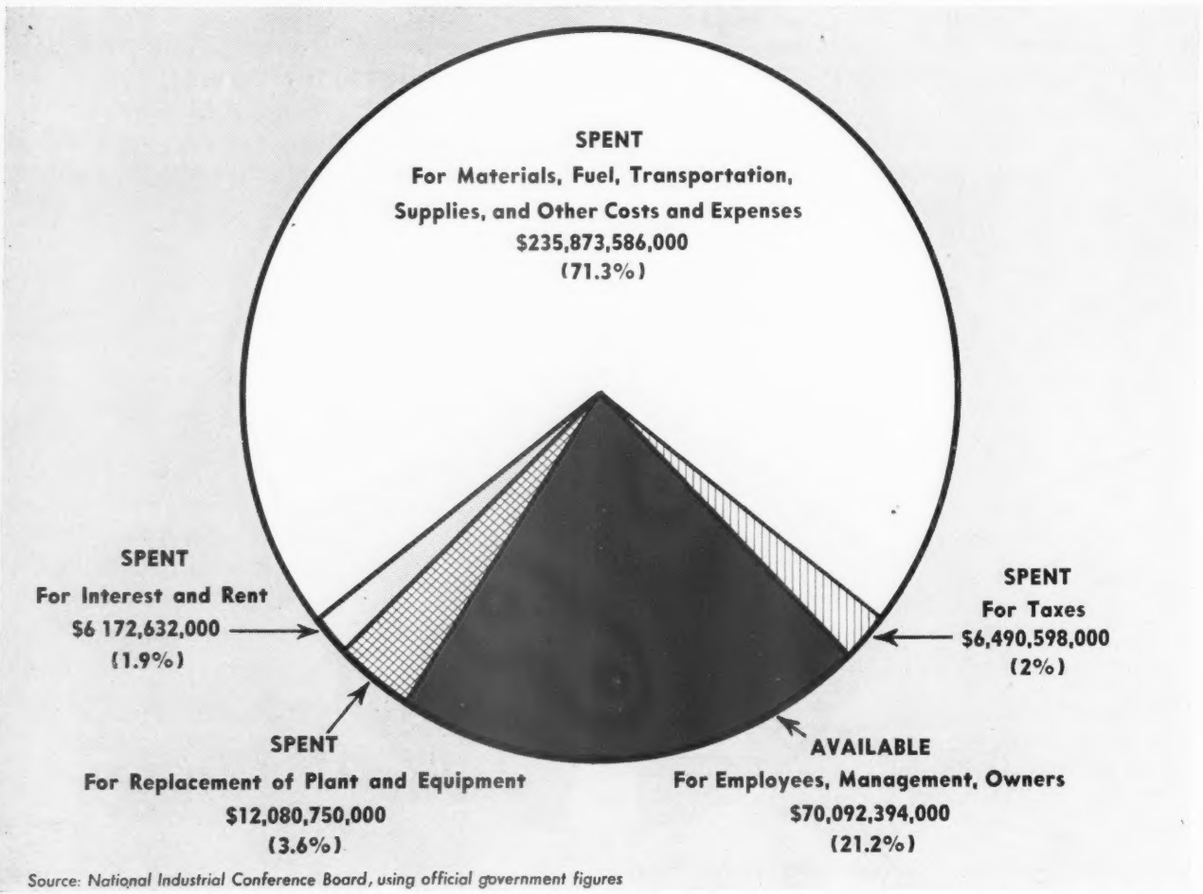
Something goes out for taxes. Something for interest on money borrowed to keep the business going. Something for replacing equipment.

All those expenses the average individual will recognize as necessary if the company is to stay in business. When he learns that these absolutely necessary expenditures take a very heavy portion of the total money received (78.8 per cent in the case of factories as a whole), he will see that the returns to employees, management, and owners must come out of what's left—unless in preceding years a cushion, or rainy-day fund, was provided.

For factories as a whole, 21.2 per cent of the money taken in was left for employees, management, and owners after the "stay-in-business" expenses were paid.

DISPOSITION OF TOTAL INCOME FOR THE PERIOD 1929-1935 ($330,709,960,000)

Manufacturing Industries



Source: National Industrial Conference Board, using official government figures

How Much Employees, Management, and Owners Got

WHAT'S REALLY uppermost in the mind of the employee wondering about his company is "Am I getting mine?" Suppose we see what the employees in all factories got during the seven years 1929-1935.

After paying for materials, fuel, transportation, and supplies—after paying the other items of expense necessary to keep the business going—what was left?

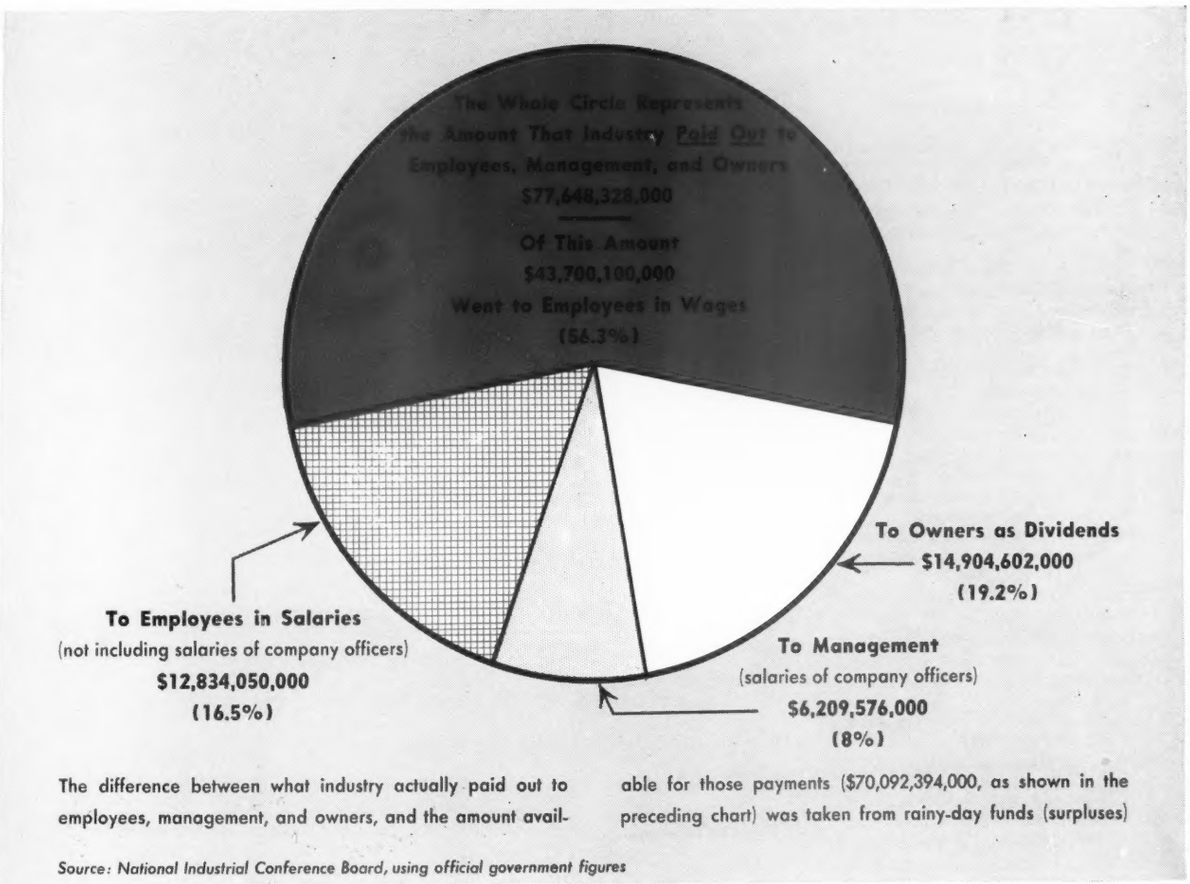
In the case of factories as a whole, it was 21.2 per cent of total income. That amount only was available to be divided among employees, management, and owners—unless, of course, there were savings to draw on.

Factories as a whole, in the years preceding 1929, and during 1929 itself, *had* made savings. And from 1929 on they drew on those savings. Actually, during the 7-year period 1929-1935 they paid out more than they took in by the amount of $7,555,934,000.

This 7½ billion dollars was added to the 21.2 per cent of total income, which amounted to $70,092,394,000. The total paid out therefore became $77,648,328,000, which was divided up as follows: 56.3 per cent to employees in wages, 16.5 per cent in salaries other than the salaries of company officers; 8 per cent in the salaries of company officers; 19.2 per cent in dividends, which was a return of about 4¾ cents on each dollar invested.

TOTAL PAID EMPLOYEES, MANAGEMENT, AND OWNERS FOR THE PERIOD 1929-1935

Manufacturing Industries



The difference between what industry actually paid out to employees, management, and owners, and the amount available for those payments ($70,092,394,000, as shown in the preceding chart) was taken from rainy-day funds (surpluses)

Source: National Industrial Conference Board, using official government figures

Combined Operating Statement, 1929-1935

All Manufacturing Corporations

Amounts in Thousands

	1929–1935		
	Dollars	Per Cent	
Income:			
1. We billed our customers for products purchased from us	316,205,286,000		
2. From which we had to deduct for bad debts	1,974,152,000		
3. Leaving us a net return from sales of	314,231,134,000		
4. We received dividends from other corporations amounting to	2,896,041,000		
5. And interest, rents, and income from other sources amounting to	13,582,785,000		
6. WHICH GAVE US A TOTAL INCOME TO WORK WITH OF	330,709,960,000	100.0	
Disbursements:			
7. We paid others for materials, fuel, transportation, supplies, and other costs and expenses	235,873,586,000	71.3	
8. We set aside to replace wearing out plant and equipment	12,080,750,000	3.6	
9. And paid interest for borrowed money and rent for leased property	6,172,632,000	1.9	
10. While government tax collectors required	6,490,598,000	2.0	
11. THIS LEFT FOR EMPLOYEES, MANAGEMENT, AND STOCKHOLDERS	70,092,394,000	21.2	100.0
12. Our employees received in salaries and wages	56,534,150,000		80.6
13. The managements of the corporations received for services	6,209,576,000		8.9
14. Leaving for stockholders net earnings of	7,348,668,000		10.5
15. Cash dividends paid to stockholders amounted to	14,904,602,000		
16. Leaving a deficit draft on capital of	7,555,934,000		

Operating Statement by Years, 1929-1935

All Manufacturing Corporations

	1929	1930	1931	1932	1933	1934	1935
Income:							
1. We billed our customers for products purchased from us	$69,235,582	$57,687,105	$41,977,513	$29,077,895	$32,612,067	$39,559,783	$46,055,311
2. From which we had to deduct for bad debts	266,914	290,592	315,137	335,329	318,063	250,657	197,160
3. Leaving us a net return from sales of	68,968,668	57,396,513	41,662,406	28,742,566	32,294,004	39,309,126	45,857,851
4. We received dividends from other corporations amounting to	583,513	547,660	391,658	210,928	160,481	388,637	613,164
5. And interest, rents, and income from other sources amounting to	2,404,894	2,574,653	1,472,734	2,522,780	2,177,107	1,171,841	1,258,776
6. WHICH GAVE US A TOTAL INCOME TO WORK WITH OF	71,957,075	60,518,826	43,526,798	31,476,274	34,631,592	40,869,604	47,729,791
Disbursements:							
7. We paid others for materials, fuel, transportation, supplies, and other costs and expenses	49,878,538	43,605,873	31,625,936	23,619,577	24,849,911	28,895,680	33,398,041
8. We set aside to replace wearing out plant and equipment	2,017,754	2,056,811	1,846,624	1,686,892	1,632,542	1,423,712	1,416,415
9. And paid in interest for borrowed money and rent for leased property	1,140,893	1,146,067	981,449	865,445	752,783	661,112	624,853
10. While government tax collectors required	1,160,611	951,825	731,148	647,334	852,823	831,661	1,315,190
11. THIS LEFT FOR EMPLOYEES, MANAGEMENT, AND STOCKHOLDERS	17,759,276	12,758,250	8,341,641	4,657,026	6,543,503	9,057,406	10,975,292
12. Our employees received in salaries and wages	12,050,212	10,237,835	7,927,730	5,539,146	5,600,380	7,137,141	8,041,706
13. The officers of the corporations received for services	1,171,888	1,095,929	935,348	734,148	706,412	753,805	812,046
14. Leaving for stockholders net earnings of	4,537,176	1,424,486	−521,437	−1,616,268	236,711	1,166,460	2,121,540
15. Cash dividends paid to stockholders amounted to	3,158,771	3,160,973	2,285,635	1,326,490	1,169,593	1,609,659	2,193,481
16. Leaving to be set aside for expansion and future contingencies	1,378,405						
17. Or a deficit draft on our capital of		1,736,487	2,807,072	2,942,758	932,882	443,199	71,941

STATEMENTS COMPILED BY THE NATIONAL INDUSTRIAL CONFERENCE BOARD, USING OFFICIAL GOVERNMENT FIGURES

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Lubrication on Incentive

For the department whose men work all over the lot, why not a scheduling and incentive plan like the one that works so well in this company's department of lubrication? It maintains close control where close supervision is impossible

GEORGE L. DIRKS

Manager, Time Study and Standards Engineering Division
The B. F. Goodrich Company
Akron, Ohio

WHENEVER a department consists of members whose duties require them to be in every nook and cranny of a large plant, proper supervision becomes a problem. A typical example is found in a department whose sole purpose is the proper lubrication of equipment. Since it is not practicable to attempt close supervision of the men, some way must be found to maintain complete control over their activities. It was this purpose that prompted the installation three years ago of a scheduling and incentive plan in our department of lubrication.

In order to make the plan basically sound it was necessary, first, to have complete time-study data. These data were accumulated by studying the individual oilers as they went about their tasks of lubricating the various bearings, reductions, and drives. The time necessary to lubricate each individual unit was recorded. In addition, records were made as to type of lubricating device in use on each bearing, such as ball-crank fitting, sight-feed cup, oil holes, and so on through all the many types of lubricating devices, including pressure systems.

It was also necessary to record for later use the conditions under which the various bearings operate, such as extremes of heat, cold, dust, and other conditions that might reflect the need for other than normal lubrication.

The time necessary to fill containers such as grease guns and oil cans was taken, and a record kept of the number of fittings serviced for each filling of the container. Time required to walk to the job and walking between machines, as well as the distance in feet covered, were recorded. Also the time consumed in waiting for elevators and walking back to lubricant supply centers was noted.

Table A

Department of Lubrication

Standard Minutes per Unit

Unit Lubricated	Description	Lub. Used	Value
Air Cylinder	Remove & replace plug	Oil	1.040
" "	Lubricate along push rod	"	.100
Balcrank	Using small hand gun	Grease	.340
"	Using small hand gun where fittings are nested	"	.280
"	Using large pressure gun	"	.370
"	Motors only	"	.850
Chains	Roller type	Oil	.430
"	Heavy webb type	"	2.130
"	Wash with coal oil	Coal Oil	1.660
Clutches	Falls - 1-AA	Oil	6.140
"	Cutter Hammer Magnetic	Grease	1.690
"	Mill jaw clutch	Oil	.680
"	Dodge, Medart	"	.370
Drip Cups	2 oz.	"	.310
" "	8 oz.	"	.620
" "	16 oz.	"	.710
" "	Adjust all sizes	"	.310
Flexible Couplings	All types	"	3.060
Gears	Calender Bull Gears	Grease	5.920
"	Mill " "	"	.940

After all these data had been accumulated, it was necessary to analyze and formulate the material in terms of standard time values. During this process it was found that for all practical purposes the value for lubricating a given type of fitting with the same lubricating device was constant.

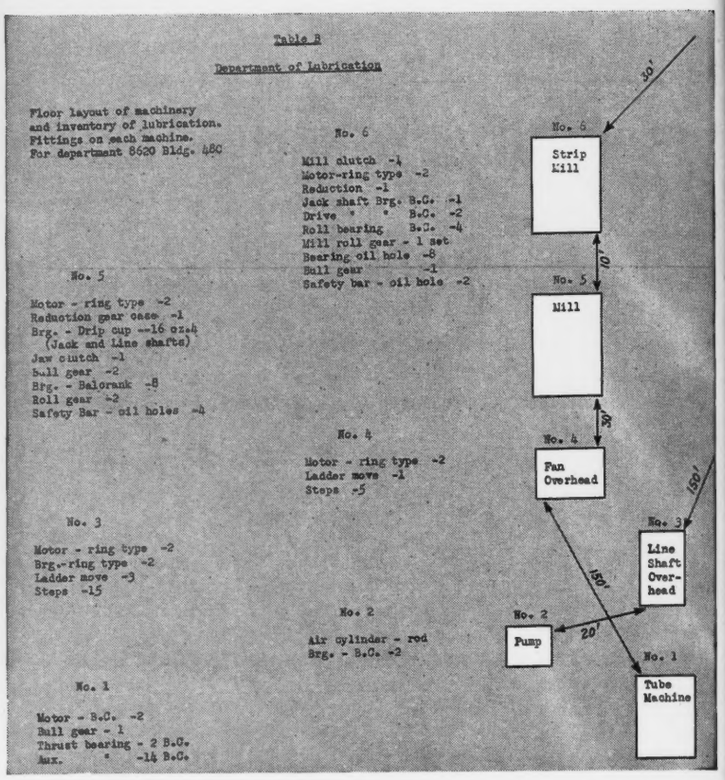
For example, the amount of time consumed in "shooting" a ball-crank fitting with a pressure gun was constant. However, the needs of the bearing that the ball-crank fitting serves are variable, depending on the importance and the amount of work the bearing is doing. The values developed are expressed in Table A in terms of standard minutes per unit.

The next step was to be sure that we knew the correct number of various types of units on each piece of equipment. In order to get this information it was necessary to make an inventory of all equipment lubricated by the department.

Inventoried All Equipment

In conducting this inventory a simple sketch was made showing the locations of the various machines and the walking distances between machines, to elevators, and to lubricant supply stations. Each bearing, reduction gear, or other unit requiring lubricant was checked and recorded, as Table B shows.

Utilization of these data was the next step. It was accomplished by drawing up the work sheet shown as Table C. As will be seen, the various columns on this sheet are headed with numbers 1, 2, 3, and so on. Thus



Lineshaft bearings on this 84-in. mixing mill are lubricated once each shift with the aid of a high-pressure grease gun

column 1 identifies the equipment and all the units requiring lubrication; 2 identifies the type of fitting serving that unit; 3 denotes the number of fittings; 4 shows the standard time in minutes per fitting.

This value not only includes the actual time of servicing the fitting but includes a necessary portion of the time for filling the container used in lubricating the fitting. Column 5 shows the product obtained by multiplying the figures in column 3 by those in column 4 and gives the total standard time for lubricating all the fittings on one particular unit of a machine. Column 6 represents the number of times each unit is to be lubricated in a 24-hr. day. The figure 1/6 denotes one lubrication in six 24-hr. periods; 4 denotes four lubrications in a 24-hr. period, and 1 denotes one lubrication in 24 hours.

It is at this point in the plan that consideration was given to the lubrication requirements of each unit. Up to now we have been concerned only with determining the amount of time necessary to lubricate a given type of fitting. This column, 6, shows how often each fitting should be serviced—in other words, the frequency with which the various units require lubrication. Actually the frequency was determined by drawing on the following sources of information: (1) Lubrication engineer; (2) maintenance superintendent's staff; (3) actual performance as demonstrated by the men on the job.

Consideration was of course given to: (1) Importance of the bearing, or the amount of work that unit is doing; (2) conditions under which it operates. For example, under extremely dusty conditions more frequent lubrication is required than the same bearing would need under ordinary conditions. Also such factors as extreme heat, bearing pressure, vibration, and so on were considered.

Tests and Trials

In any instances where the three available sources of information were not in close agreement as to the required frequency of lubrication, actual trials and tests were made.

The importance of this particular phase of the work cannot be overestimated, when it is realized that if these items are not correctly determined bearing failures will occur due to under-lubrication, or there may be over-lubrication, with its attendant waste of time and material.

Columns 7, 8, 9 and 10 in Table C are used to segregate the standard times for use later in delegating the work to various shifts. In checking the figures in these columns it will be noted that wherever the fractions 1/6, 1/12 and so on appear the total standard time has been divided by these figures. In other words, the work was delegated to the daily shift and the responsibility of saying on what day of the week a certain unit is to be lubricated was worked out later with the individual oiler. Usually the schedule was worked out in such manner that a definite number of these items are lubricated each day in order to balance the work properly over the week.

Column 11 shows the amount of work which for safety reasons can be done only when the equipment is shut down. This work is not delegated to any particular shift but is performed by all shifts depending on when the equipment is available. If certain equipment cannot be shut down for lubrication during the week, that work is done on Sunday. It must be lubricated once each week and is known as "shutdown work."

The work shown in column 12 is similar to that in column 11 in that it is not delegated to any particular shift. Usually this work is done during the semi-annual inventory shutdown period.

It will be noticed in Table C that such items as "ladder," "steps," and "shift constant walking" appear. These items compensate the individual oiler for the necessary walking time in getting from machine to machine, moving his ladder from one lineshaft bearing

(*Continued on page* 114)

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Table C
Department of Lubrication
Work Sheet

Department 8620 Bldg 48 Floor C Sheet 1 of 2 Sheets

1 Equipment	2 Type of Lubricator	3 # Points	4 Std Min per point	5 Total Std Min	6 # times hit in 24 hrs	7 Std Min A Shift	8 Std Min B Shift	9 Std Min C Shift	10 Std Min D Shift	11 Shut Down work weekly	12 Shut Down work Semi-Annually
1. Tube machine											
Motor	Balcrank	2	.850	1.700	6 mos						1.700
Bull gear	grease	1	.430	.430	1/6		.072				
Thrust bearing	Balcrank	2	.340	.680	4	.680	.680	.680	.680		
Aux. "	"	14	.340	4.760	1		4.760				
						.680	5.512	.680	.680		1.700
2. Pump											
Air cylinder	Rod	1	.100	.100	1/6		.017				
Bearings	Balcrank	2	.340	.680	1		.680				
							.697				
3. Line Shafting (overhead)											
Motor	Ring type	2	.290	.580	Shut dn					.580	
Bearings	" "	2	.250	.500	" "					.500	
Ladder	(move)	2	.412	.824	" "					.824	
Steps	(climb)	15	.0317	.476	" "					.476	
										2.380	
4. Fan (overhead)											
Motor	Ring type	2	.290	.580	1/6		.097				
Ladder	(move)	1	.412	.412	1/6		.069				
Steps	(climb)	5	.0317	.159	1/6		.026				
							.192				
5. Mill unit											
Motor	Ring type	2	.290	.580	Shut dn					.580	
Reduction	Cleveland	1	1.650	1.650	1/6		.275				
Jack & main bearings	Drip cup 16oz	4	.710	2.840	4	2.840	2.840	2.840	2.840		
adjust	cups	4	.310	1.240	4	1.240	1.240	1.240	1.240		
Clutch	jaw clutch	2	.680	1.360	4	1.360	1.360	1.360	1.360		
Bull gear	grease	2	.940	1.880	1/6		.314				
Roll bearings	Balcrank	8	.340	2.720	1		2.720				
Roll gears	Splash Pan	2	.790	1.580	1/12		.132				
Check	" "	2	.250	.500	1		.500				
Safety bar	Oil holes	4	.100	.400	Shut dn					.400	
						5.440	9.381	5.440	5.440	.980	
Shift constant walking		220 ft	.0055	1.210	4	1.210	1.210	1.210	1.210		
Per week " "		170 ft	.0055	.935							.935

Table D

Department of Lubrication

Summary and Shift Distribution

Production Dept - 8620 Bldg. 48-C

Equipment	Std.Min. 1st Shift	Std.Min 2nd Shift	Std.Min. 3rd Shift	Std.Min 4th Shift	Weekly Shut down	Semi-Annually Shutdown
1. Tube machine	.680	5.512	.680	.680		1.700
2. Pump		.697				
3. Line shafting	"				2.380	
4. Fan		.192				
5. Mill unit	5.440	9.381	5.440	5.440	.980	
6. Strip mill	1.695	5.330	1.695	1.695	.796	
Constants	1.210	1.210	1.210	1.210	.935	——*
Total	9.025	22.322	9.025	9.025	5.091	
Hrs.	.15	.37	.15	.15	.09	

*Necessary constants determined when work is scheduled.

Table E

Department of Lubrication

Schedule Sheet

Route #29 2nd Shift Week of 6/5

Dept.	Bldg.	Std. Hrs.	Days per Wk.	Hours per Week
8610	51-AA	.97	6	5.82
8610	51-A	2.06	6	12.36
8611	48-A	.79	6	4.74
8611	48-B	1.84	6	11.04
8620	48-C	.37	6	2.22
		6.03		36.18

Table F

Department of Lubrication

Dept.8605 - Bldg.48-D

Work Specifications

Second Shift

Every day equipment operates

1. Grease ball crank fittings on mills, tubers and heater cars
2. Lubricate oil holes on tuber bearings, black rock cutter bearings, and channel trimmer bearings
3. Turn down grease cup on buffer

Every 3 days equipment operates

1. Service ball cranks on black rock

Every 4 days equipment operates

1. Fill grease cup on buffer

Every 6 days equipment operates

1. Lubricate mill drive gears, tuber drive gears and all motors
2. Service reductions and gear cases.
3. Service oil bath bearing on channel trimmer and Reeves drive on black rock cutter
4. Lubricate overhead motor fan line shaft bearings
5. Lubricate bull gears on mills

Every 12 days equipment operates

1. Fill mill roll gear, slush pans

Relays Keep Production Up

When properly set they can protect machines as well as motors against dangerous overloads or abnormal conditions

GILBERT LINDGREN

Electrical Foreman
Hudson Valley Fuel Corporation
Troy, N. Y.

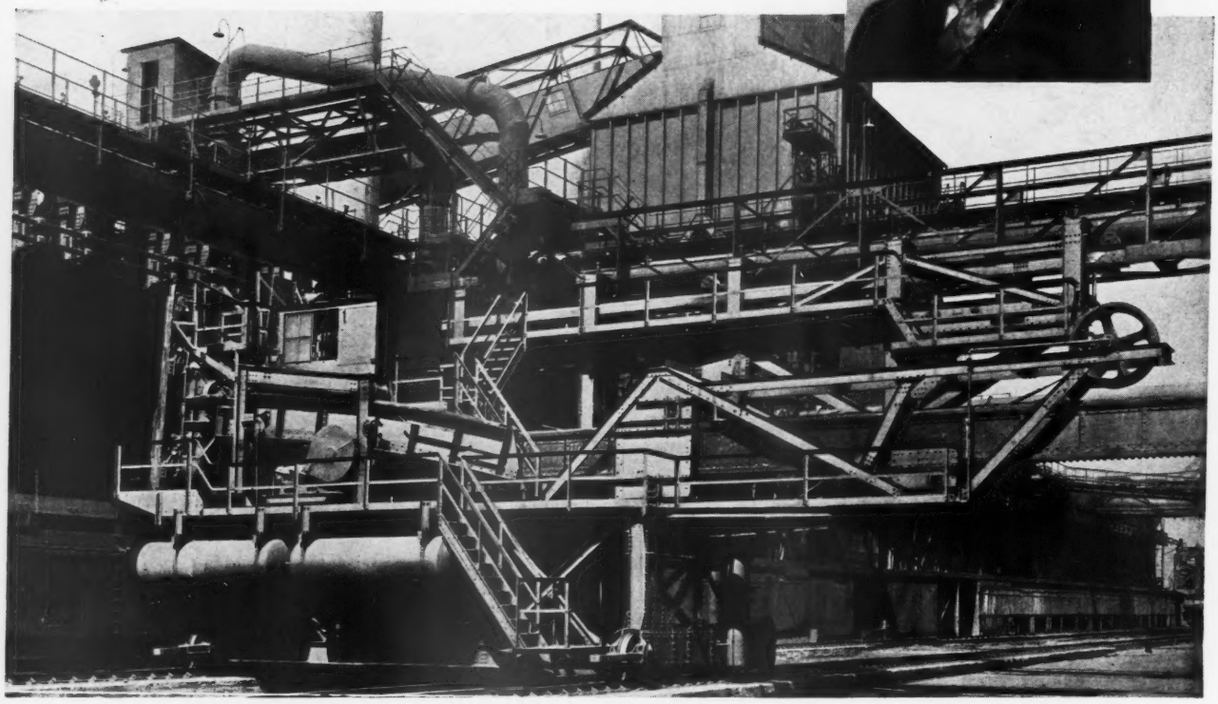


Figure 1. Overload relays on the coke pusher are set to protect it and the ovens from damage

RELAYS used for the protection of motors usually are classed as overload relays. They are installed for the purpose of protecting the motor against overloads or any abnormal currents that might cause a failure.

It is well to remember, however, that such relays may be made to serve as a protection against other than motor failures. For example, one or more relays may be installed in a motor circuit for any of the following reasons:

1. To guard against failure of the motor only.

2. To guard against failure of the driven unit, or against an abnormal load on the motor or the driven unit.

3. To guard against an abnormal operating condition which may be more important than the protection of the motor or the driven unit.

Since the manufacture of gas must go on 24 hours a day, 365 days a year, every precaution has to be taken to insure continuous production. Therefore, in this plant we pay particular attention to operation and operating conditions as a whole, rather than give special consideration to any department or machine.

A principle we have followed and found effective as a guard against undue failures is that any protective device installed on a motor should, first of all, be considered as a guard against an operating failure, rather than as a means of protecting the motor only.

I do not mean to imply that all motor-driven units can be protected against breakdowns by the proper application of overload relays. As a matter of fact, however, it is often an easy matter to afford considerable protection to a driven unit, or to operation as a whole if, when possible to do so, relays are adjusted so as to protect the entire unit.

Considering the three types of protection mentioned previously, there is need for:

1. Protection of the motor only. Where a motor is operating continuously at or very close to its safe maximum load, it becomes the weakest link and must necessarily be considered first. Operation of a signal to give warning of an impending shutdown may be arranged by connecting two overload relays in series. The auxiliary relay is set slightly lower than the main relay, and closing of its contacts operates the signal.

2. Protection of the driven unit. Protective features on our coke pusher, Figure 1, provide a good example of this type. Resistors are connected in the circuit of the motor operating the door extractor and door-lifting mechanism which allow the motor to stall if the load is above normal. This arrangement prevents the operator from applying more than a predetermined amount of pressure on the oven doors, and also limits the stress on the lifting machine. The relays are set to operate at this maximum load with a time delay of about 15 sec., which prevents the motor from being stalled for too long a period.

3. Protection against an abnormal operating condition. This same coke pusher affords a good example of what I have in mind.

Coke is made in a long, narrow oven and when finished it is pushed out by a motor-driven ram. The amount of pressure required to move the coke is an indication of the conditions; therefore the operator notes and keeps a record of the ampere reading as each oven is pushed.

Figure 2 shows a chart of the ampere load on the motor driving the ram. It will be noted that the maximum load is of only a few seconds' duration. This period represents the time required to start the coke moving out of the oven; when it is once in motion the load drops off rapidly. If for any reason the coke should fail to move, the column it forms would spread or buckle and cause a dangerous pressure on the side walls of the ovens. The relays are adjusted to guard against such excessive pressures.

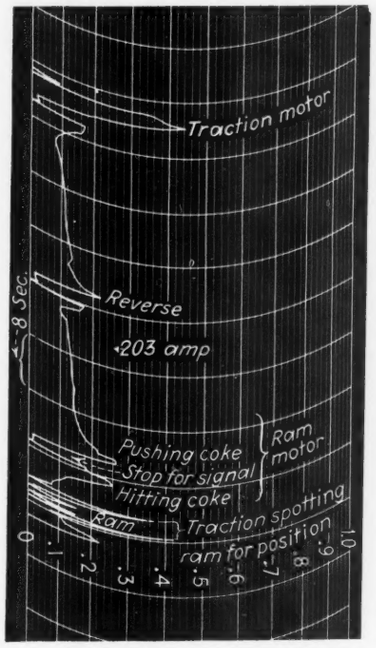


Figure 2. Charts from a graphic ammeter give a permanent record of the operation of the coke pusher

Load charts like this one are filed and serve as a permanent record in case any question should arise regarding the correct setting of the relays.

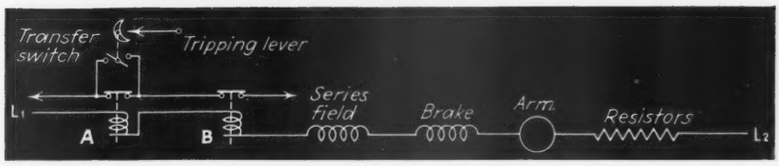


Figure 3. As the pusher moves from one battery of ovens to the other, automatic tripping of the transfer switch cuts relay *A* in or out of the circuit, to give different tripping values

A Relay for Each Oven

The coke pusher serves two batteries of ovens. On one battery the allowable ram pressure is less than on the other. This condition is taken care of by using two relays connected in series and controlled as shown in Figure 3. Relay *A* is set at 225 and relay *B* at 350 amperes, each having a time delay of approximately 5 seconds. The diagram shows the connections when the machine is at the ovens protected by relay *A*. As the machine moves to the ovens protected by relay *B*, a bracket mounted along the running track trips the transfer switch, which short circuits the control contacts of relay *A* so that relay *B* only is in the operating circuit.

A 600-hp. motor direct connected to a single-stage, 8-step, free-unloading gas compressor furnishes another example of an installation where protective devices on the driven unit are interconnected with the motor control. Before this compressor can be started, the oil pressurestats and bearing thermostats must be at their proper setting.

Since this compressor is very important from the standpoint of continuity of service, undue shutdowns are avoided by the use of a time relay in the control circuit of the bearing thermostats. If the temperature of a bearing rises above normal, the operator is given a warning signal about a minute before the stop circuit is opened.

The purpose of the time relay on the bearing trips is to give the operator time to inspect the hot bearing. He can then prevent the relay from tripping, if there is no immediate danger.

Proper setting of protective devices to prevent major failures is one thing, but its application is another problem, unless the electrical department has the full cooperation of both the mechanical and the operating departments. This cooperation is absolutely essential.

Our electrical department is very fortunate in being part of an organization in which the management sees to it that the various departments cooperate so as to get the best possible service from its equipment, and also make sure that its equipment is doing just what it was designed to do.

There are plants in which the operating departments are in supreme command. I know of one instance where all crane operators were removed from the supervision of the electrical department and placed under the operating force because of lack of cooperation between these two departments. The result was a great increase in crane repairs and breakdowns.

The more closely relays are set to protect equipment, the greater the number of interruptions to operation that must be expected. It is the duty of the maintenance and the operating departments to work out these individual problems and arrive at the point where equipment will receive the highest degree of protection possible, with the least interference with production.

When we strike that balance, we are on the road to lower manufacturing costs. That is what we are all working for, whether we belong to the maintenance or to the operating department.

CORRECTION

In the article by E. H. Vedder, in the August issue, the following formula was given for determining the size of cable required by electronic timers for resistance welding machines:

$$\textit{Required Rating in Amperes} = I_{max} \times \textit{Per Cent Duty Cycle.}$$

This formula should read:

$$\textit{Required Rating in Amperes} = I_{max} \times \sqrt{\textit{Per Cent Duty Cycle.}}$$

Phone Systems Within the Plant

The last of four informative articles describes the new electronic, loud-speaking, intercommunicating telephones

FREDERICK SMITH
Vice-President
J. O. Oliver & Company, Inc.
New York

A typical master station with nine-station selector switch. Just above it is the talk-and-listen switch. A five-station model can also be had

WITHIN the past two years a new type of electronic, loud-speaking, intercommunicating telephone has been developed and placed on the market. In some respects these new instruments appear to have a number of advantages over the conventional, low-voice type described in the preceding articles.

These new telephones are primarily a development of the radio manufacturing industry, and consist essentially of a three- or four-tube amplifier, a permanent-magnet, dynamic loud speaker, volume control switch, and a talk-and-listen switch. The component parts are assembled on a metal chassis and inclosed in a hardwood cabinet of approximately the same size and general design as a small table radio receiver.

When the talk-and-listen switch is pressed, while the person is talking, it permits the loud speaker unit to function as a dynamic microphone or transmitter, upon releasing the switch to its normal or listening position, the loud speaker becomes a receiver or reproducer. A combination volume control and on-and-off switch is usually provided for regulation of the sound level and to cut off the power supply when the instrument is not in use. Either alternating or direct current for operation of the system is obtained by plugging into any convenient lighting circuit receptacle.

Instruments of the type described are usually termed "master" stations to differentiate them from "remote" stations or speaker-microphone sets which consist of permanent-magnet, dynamic speaker units without amplifiers or switches, inclosed in hardwood cabinets with grille openings in the front and rear.

The various units of apparatus that makes up such an intercommunicating system may be either all master stations, or a combination of master and remote stations, depending upon the service requirements. For example, a pair of master stations may be installed in adjacent offices and connected for use as a two-way, private-line system between an executive and his secretary. Or a system may comprise a master station for the executive only, with remote stations for his secretary and each of his immediate assistants.

Calling Nine Stations

In the latter case, the master station would be equipped with a selector switch, on one point of which all the remote stations can be called simultaneously, while several other points permit each remote station to be called individually. Again, a system may be made up of several master stations, all provided with selector switches for full selective-talking intercommunication, so that any station can call any other station.

An optional feature on master stations of this type is that an auxiliary, watch-case receiver can be used which automatically silences the loud speaker when it is desired to hold a confidential conversation, or to avoid disturbing others who might be in the same room at that particular time. A typical instrument of this type is shown in the first illustration. Its selector switch can call nine other stations. Another model of the same type is equipped with a switch for calling five other stations.

Apparatus of the type and size so far described covers the range of lower-priced models produced by most manufacturers. Prices of instruments without installation or wiring vary from approximately $10 for a speaker microphone station to $40 for a five-call, or $50 for a nine-call master station. Complete equipment for a two-station system with master stations is about $80.

To meet the requirements of organizations where master stations of larger capacity may be needed, or where additional facilities for station selection and identification are desired, one

manufacturer has introduced within the past few months new models of master stations built in sizes of 12- and 24-station calling capacity. In one style these instruments are provided with individual station selector keys of the lever type, while in another model individual visual signals associated with each of the keys and an audible buzzer signal provide a means of indicating each incoming call.

These instruments may also be used in combination with the lower-priced master stations with rotary selector switches, or with remote speaker-microphone stations equipped with pushbuttons for operation of the visual signals at the master station.

Instruments in this class, with individual selector keys, cost about $80 each in the 12-station size or $92 each in the 24-station size. Similar instruments with the addition of individual visual line signals are priced at about $103 for the 12-station or $125 for the 24-station sizes.

In such locations as machine shops or workrooms of various types in manufacturing plants where the sound level caused by the operation of machinery is abnormally high, it is obvious that loud-speaking telephones are not so well suited to the conditions as low-voice instruments, particularly those of the handset type. In the average plant, however, because of the relatively small number of such locations at which intercommunication is usually necessary, in proportion to the total number of stations required, this condition does not present a serious problem and could probably be overcome by the installation of dynamic-type handset telephones in such places, with a simple form of relay-operated signal for calling purposes.

Distracting to Others?

The question is occasionally raised as to whether the use of loud-speaking receivers on several desks in the same office is likely to be distracting to others. Actual experience indicates that where the volume is properly controlled no more confustion or interference is caused than in the one-way transmission that is overheard when a conventional telephone system is used.

In such locations as shipping and receiving departments and stockrooms, loud-speaking stations of the remote, speaker-microphone type have a distinct advantage over the low-voice system in that calls for information can frequently be answered at considerable distances from the instrument, without requiring the person to drop his work and go to the nearest telephone.

In many organizations the combination of a small master station installed at the telephone switchboard and a number of speaker microphones distributed at convenient locations throughout the plant can be made to serve as an effective paging system. As many as ten speaker microphones of the type used for office intercommunication may be operated simultaneously without overloading the amplifier. With such a system the telephone operator can quickly locate a person who is away from his desk, and he in turn can answer back.

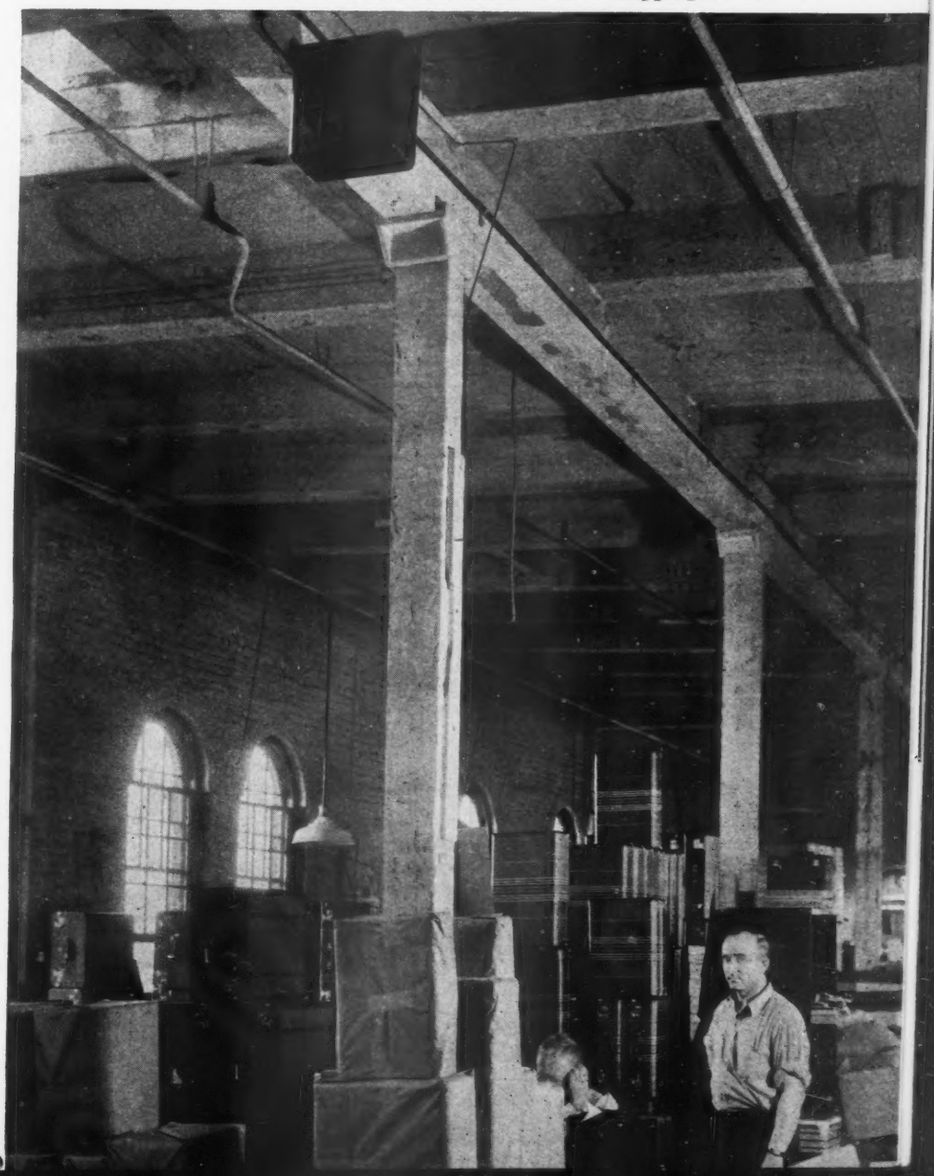
Where large areas are to be covered and the regular 5-in. speaker microphones are too small, a paging system is available in which the master station is equipped with an amplifier that has a capacity of 5 watts and is capable of operating up to ten speaker microphones having 10-in. units. With this system, under average conditions, a single speaker microphone will frequently cover an area of 5,000 square feet, and permit the person called to reply at distances as much as 50 feet from the speaker microphone. Equipment for this service costs about $70 for the master station and $21 for each speaker microphone.

In general the wiring for a loud-speaking, intercommunicating system is essentially the same as for the various types of selective-talking systems described in the August issue, with the possible exception that open wiring from cable terminal boxes to speaker microphone stations should preferably be of a shielded type in which a loosely woven wire braid is placed over the twisted-pair conductors as an additional safe-guard against inductive disturbances. For the same reason, where cable is required that has several pairs of wires between master stations, the type with an outer sheathing of lead which can be grounded is preferable to that having a braided cotton covering.

From the standpoint of maintenance and upkeep there is no reason why

(*Continued on page* 114)

Remote speaker-microphone stations are just as effective, and out of the way, when mounted overhead. This 10-in. model is in a shipping room



WHEN CONNECTING MOTOR

It makes lots of difference whether the load is easy to start, and uniform, or fluctuates widely. Motor and mechanical connection react differently to such conditions

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WHEN YOU ASK a motor manufacturer whether he can furnish a squirrel-cage motor of a certain rating, suitable for full-voltage starting, the answer invariably is: "Yes, but are you satisfied that the electric power supply is adequate to handle the acceleration peak demand? Also, what will be the effect of this peak on the coupling, gear, chain, or belt connection between the motor and the driven machine?"

Fluctuating and high-starting-torque loads affect the design of the mechanical connection between motor and load much more than they affect the selection of the motor. As a matter of fact, a load that consists of a succession of very high peaks, separated by periods of rest or reduced load, may permit the use of a smaller motor than would be required for a constant load much more than they affect the peaks of the fluctuating load.

Such is not likely to be the case, however, with the connection between motor and load. The fluctuating load may require a heavier coupling, belt, chain, or gear than the steady load. For example, curve *A* in Figure 1 represents the load curve of a conveyor operating 8 hours a day. It will be noted that after the conveyor is started it runs with practically no change in load. The majority of drives, including centrifugal pumps, fans, and lineshafts, have a load curve of this same general character.

There was recommended for the load represented by curve *A* a 30-hp., continuous-rated motor with a gear reduction using a 3½-in. face, six-pitch-diameter pinion. A reasonably long life can be expected from this gearing.

Smaller Motor, Heavier Gear

Curve *B* is the load curve of a crane hoist working on fast-duty-cycle work. To handle this load a 30-hp., one-hour-rated motor will be used. This motor is rated on an intermittent basis and is built in a smaller frame than the conveyor motor handling the load represented by curve *A*. However, the gearing used must be heavier rather than lighter than that used on the conveyor drive. The pinion should be 5 inches wide and of 5½ diametral pitch in order to last as long as the curve *A* gear. In other words, the fluctuating load takes a smaller motor but a heavier gear than the steady load.

Furthermore, if the curve *B* cycle were continued for 24 hours a day instead of 8, the motor recommendations would not change, but the gear would have to be still heavier. The reason is that the life of a gear is in direct proportion to the length of time it is in service. This situation is not true of a motor that has been properly applied.

Reducing the diametral pitch means that the number of gear teeth per inch of diameter of the pitch circle becomes less and the teeth are larger and stronger, therefore better able to

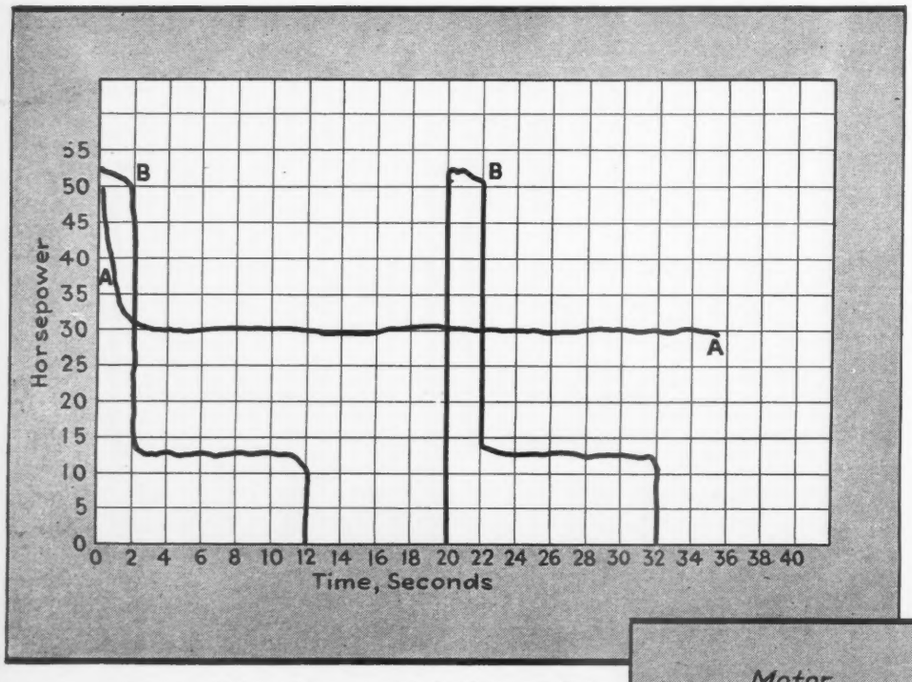

Figure 1. Curve *A* represents load imposed by a conveyor; *B*, a fast-duty-cycle crane hoist

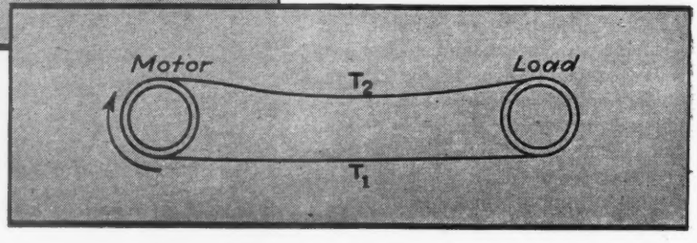

Figure 2. With a belt drive the load-transmitting tension, T_R, is the difference between tensions T_1 and T_2. Total tension, or stress on the bearings, is the sum of T_1 and T_2

AND LOAD

stand the recurring shock loads put upon them.

Why should changing from a load represented by curve *A* to a load represented by curve *B* affect motor and gear in exactly opposite ways? It is entirely due to the difference in the way the motor and the mechanical connection react to the peak loads put upon them.

There is no mechanical connection between the rotor and the stator of the motor. All torque reactions must pass through an air gap. The rotor is pulled around by magnetic forces like invisible bands of rubber. Consequently the magnetic coupling between stator and rotor presents a kind of buffer to shock loads, much as a skilled boxer absorbs the punches of his opponent on his own padded gloves, without injury. The bearings are the only parts of the motor that have any metal-to-metal contacts subject to shock. They are, therefore, the only parts of the motor that are subject to the same laws that govern connections between motor and load.

Each peak load that occurs is reflected back into the electrical supply line by an inrush of current. Its effect on the motor is to increase the internal heating. With a synchronous motor enough current is drawn from the line to carry it over the peak. In the case of an induction motor more current is also drawn from the line, but the rotor slows down momentarily and some of the stored energy in the rotor helps to carry the peak load.

A Flywheel Reduces Peaks

In some applications a flywheel is used which relieves the power lines of a still larger portion of the peak load. Sometimes a motor is designed so as to have a speed-torque curve which provides an extra amount of slip when the peak load occurs, and this slip in turn allows the flywheel to give up some of its stored energy to handle the excess load. In any event, the extra current due to the peak load causes the motor to heat up, but if the peaks are not too frequent the heat will be dissipated by radiation and and the motor will not be injured.

A coupling, gear, belt, or chain, however, represents a more or less inflexible connection between the load and the motor. If repeated shocks to the drive, as indicated by curve *B*, do not cause quick failure of an under-sized connection, they will be sure to cause excessive wear and short life.

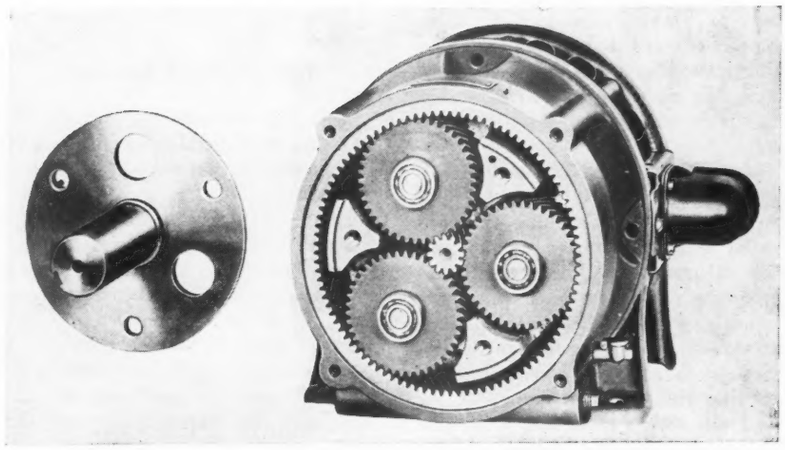

Figure 3. In this gear motor a planetary reduction with helical gears is used to reduce speed of motor shaft to value desired for output shaft

They React Differently

Service factors of loads must be considered. Where the service is unusually severe, due either to recurring peak loads or to 24-hr. instead of 8-hr. service, a heavier mechanical connection is to be recommended. Although these problems are familiar to those conversant with the mechanical end of various drives, they may not be so familiar to electrical engineers. Also, the reverse may be true. The mechanical engineer may not be aware of the fact that an electric motor can take peak loads without injury up to the breaking-down point of the motor itself, provided these peaks are not so frequent as to overheat it.

Motor and mechanical connection to the load likewise behave differently on stalling loads. If a drive stalls, little or no harm will be done to the gearing or coupling, no matter how long the stalled condition exists, but the motor will probably go up in smoke unless relieved by the overload relay.

In order to obtain a high ratio through spur gears, it becomes desirable to reduce the diameter of the motor pinion to a minimum, so that the driven gear will not be too large. However, reducing the pinion diameter puts a greater load on the motor bearing. The reason is apparent when it is recalled that torque applied to a shaft is force measured in pounds at 1-ft. radius. For a given horsepower and speed, the force increases in direct ratio as the lever arm decreases. This condition also exists with a chain drive, but in this case the effect of the weight of the chain must also be taken into consideration.

Where Belts Are Used

With flat belt drives, consideration must be given to the fact that the stress on the bearing is equal to the sum of the tensions of both top and bottom belt strands. Usually the minimum allowable pulley diameter is twice the minimum allowable diameter of the sprocket used with a chain drive on which no initial tension is required. With a flat belt drive the required friction cannot be obtained without a certain initial tension in the belt; even though an excessively loose belt may transmit the required power, it may start flapping and cause excessive wear on the bearings.

Too much tension will also cause excessive bearing wear. Referring to Figure 2, T_1 represents the tension on the tight or driving side, and T_2 the tension on the loose side of the belt. The resultant tension, T_R, which transmits the load, is equal to the difference between T_1 and T_2, but the total pull T_t on the bearing is the sum of tensions T_1 and T_2.

At a belt speed above 5,000 f.p.m.,

centrifugal force tends to throw the belt off, or at least seriously reduce the frictional contact with the pulley. To avoid this condition the operator may decide to tighten the belt, use a wider belt, or reduce the diameter of the pulleys. Any one of these expedients may be satisfactory under some conditions, but they all tend to put higher stresses on the motor bearings. In addition, excessive tension may materially reduce the life of the belt.

Motor manufacturers endeavor to guard against bearing trouble from these causes by publishing standard pulley dimensions for each motor rating. Diameters of sprockets for chain drives can usually be taken as half the values given for pulleys, as explained previously. Using a pulley of smaller diameter than the published value may be allowable, but the nature of the load will have a good deal to do with how far it is permissible to go in this direction.

Outboard Bearings

The higher-speed induction motors are, of course, more desirable for any application because of their lower cost, smaller sizes, lighter weight, and superior operating characteristics in the way of higher efficiency and power factor. When gearing such motors it will be found that the peripheral speed of the motor pinion will in some instances be higher than good practice may dictate. Under such conditions pounding of the bearings may result. This trouble may be corrected by using an outboard bearing on the motor shaft.

Two instances come to mind where two hoists were equipped with induction motors of different makes. Bearing trouble developed with each motor, causing numerous production delays. Both motors were fitted with overhung pinions, and in both instances the pitch-line velocity of the pinions was around 2,000 f.p.m., whereas motor manufacturers' standards recommend a maximum of 1,300 f.p.m. When these motors were replaced with others having outboard bearings, all trouble stopped.

Sometimes use of an outboard bearing is not feasible, because of space limitations. In such instances antifriction bearings in place of sleeve bearings should be considered. In a sleeve or plain bearing the rotating element must turn on a film of oil. Aside from the heat conducted to the oil from the motor, there is a certain internal friction loss in the oil. As the oil gets hotter its viscosity decreases, causing the oil friction loss to decrease, and serving as an automatic check on further heating of the bearing. This action has been demonstrated by tests, using various bearing pressures.

Above a certain value of loading per unit area, the film of oil breaks down.

Metal-to-Metal Contacts

Rotating elements in antifriction bearings have metal-to-metal contacts and do not depend on the oil to support the load. Therefore this type of bearing will carry more load than the sleeve or plain type, for a given amount of space. It will be found in some instances that when an overhung load on a pinion produces stresses beyond the capacity of a sleeve bearing, a spherical roller bearing will meet the load requirements and save the expense of, and the space required by, an outboard bearing on the shaft of the motor.

Since 60-cycle motors can be designed with much better characteristics at speeds of 900, 1,200, 1,800, and 3,600 r.p.m. than at lower speeds, it is desirable to use them and, when possible, connect them directly to the load. Such equipment as centrifugal pumps, fans, and some types of woodworking machinery have been designed to operate at one or another of these higher speeds, thus permitting direct coupling.

On many drives, however, the driven machine must run at a much lower speed than is obtainable with standard motors. Such drives include conveyors, lineshafts, and hoists.

All in One Piece

For example, a 300-f.p.m. conveyor with 16-in. diameter head pulley would require a pulley speed of 71 r.p.m. Since many conveyors must run much slower than this a head pulley speed as low as 25 r.p.m. is by no means unusual. A direct-connected motor for such a drive would be a monstrosity. Its size and cost would be out of all reason. Therefore, in order to obtain the advantage of a low-cost, highly efficient motor, it was inevitable that the motor and gear reduction should be combined in one compact unit in what is commonly known among plant men as the gear motor.

In Figure 3 is shown a planetary form of gear motor which has the same general form as the ordinary motor, except that it is somewhat longer. The advantages of high efficiency and power factor obtainable in a four-pole, 1,800-r.p.m. induction motor can now be obtained with an output speed as low as 13 r.p.m. and at a mechanical efficiency of around 95 per cent. In the motor shown helical gearing is used, affording the advantage of having more teeth in contact than with spur gearing. The internal ring gear further increases the area of tooth contact.

Since the planet gears advance about the inside of the ring gear with the rotation of the center pinion, the final ratio of the speed of the output shaft to the speed of the motor shaft is increased by one more than the normal diameter relationship. For example, a 12-tooth pinion meshing with a 48-tooth gear will give a reduction ratio of 4 to 1, whereas in a planetary system it is 5 to 1.

Match Coupling and Load

Whether a motor is direct-connected to its drive or whether a gear reduction in the form of a built-in or external gear box is used, the rating of the coupling required must be carefully considered.

The size of the coupling is based on the formula:

$$Torque = \frac{Hp. \times 5{,}250}{R.p.m.}$$

Coupling designers will modify this formula by a service factor depending on the type of load. A steady load such as represented by curve *A* in Figure 1 has a low service factor. On crane, hoist, and elevator applications starting is frequent and stronger couplings are needed. Hammer mills and reciprocating compressors require still stronger couplings. They are usually either of the rigid, flanged type, or the flexible type.

There is also available an hydraulic type which partakes of the nature of a clutch. This coupling has the advantage of allowing a squirrel-cage motor to come up to speed at practically no load, or at reduced load, thus shortening the duration of the inrush current. It is also designed to allow the motor to run when a stalling load occurs, and draw much less than its stalled current.

In a coupled drive, the rotating member of the driven machine may be entirely supported on its own bearings, in which event only a torsional stress is transmitted to the motor shaft. If the motor must also support all or part of the rotating element of the driven unit, there is an additional bending stress on the motor shaft, and the bearings must be checked for their ability to carry this load without injury or excessive wear.

Time Values for Arc Welding

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COATED ELECTRODES for arc welding were introduced at the Sharon, Pa., plant of the Westinghouse Electric & Manufacturing Company in February, 1934, at which time extensive tests and time studies were made to determine the possibility of their replacing bare electrodes. Taking advantage of the better quality of weld obtained with the shielded arc method, 5/42-in. diameter bare electrodes were replaced with 3/16- and ¼-in. diameter coated electrodes. Another saving materialized by reducing the size of the weld, whenever changing from bare to coated electrodes.

All welds are made in conformity with the A.S.M.E. code for the fusion welding of unfired pressure vessels for all classes except class 1, and cover the manual welding of steel transformer tanks.

Before the introduction of the coated electrode, time allowances were established by measuring the time taken to put down a given number of inches of weld. The time allowance per inch was determined by dividing the number of inches of weld (for a given size) into the time allowed per welded seam. This method was not satisfactory, however, because there was no accurate control over the size and density of the weld produced.

The increased cost of the coated electrode also demanded closer supervision of the amount of welding rod used; therefore, after considerable study of the welding procedure, time studies were made per deposited electrode, regardless of the size of the weld. This change was based upon the fact that for a fixed current rating and size of electrode it will always take the same time to melt one electrode for any size of weld.

Before setting standard time allowances the following variables have to be considered and standards selected:

1. Type, size, and length of electrode.
2. Welding current.
3. Ratio of metal deposited per electrode.
4. Weight (size) of weld deposited.
5. Oversize allowance per inch of weld.
6. Number of layers of weld deposited.

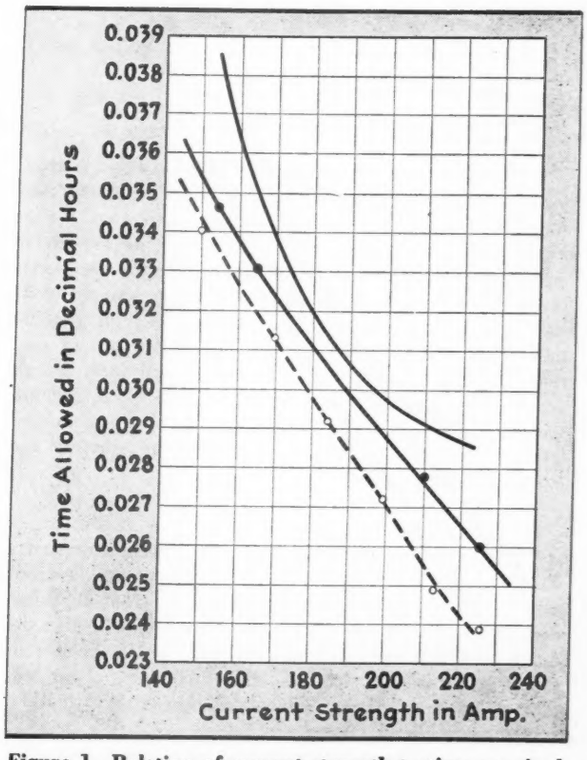


Figure 1. Relation of current strength to time required to deposit one 3/16x18 in. electrode

By accepting a uniform relationship between these variables and determining the proper current strength, a standard technique of welding has been developed and time values have been figured for each individual case or size of weld.

Type, Size and Length of Electrode—Each of the many types of coated rod on the market has its own characteristics as to speed, coating, deposited metal, and so on. Selection of the proper electrode, therefore, is very important and requires considerable experimenting.

* Since these studies were made Mr. Jacobsen has become associated with the Metallurgical Department of American Steel & Wire Company, Cleveland.

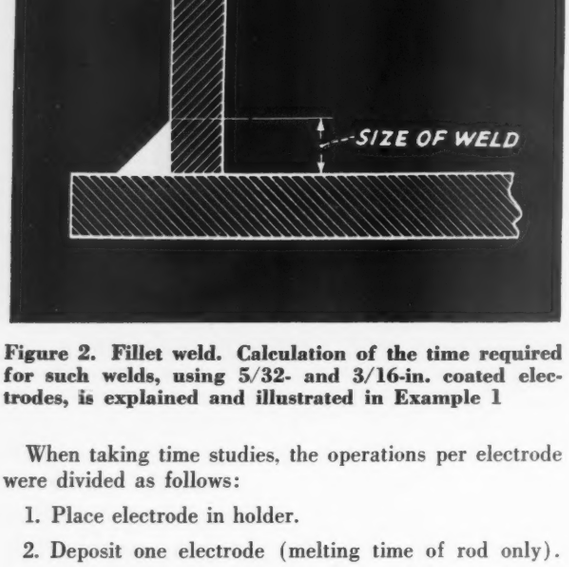


Figure 2. Fillet weld. Calculation of the time required for such welds, using 5/32- and 3/16-in. coated electrodes, is explained and illustrated in Example 1

When taking time studies, the operations per electrode were divided as follows:

1. Place electrode in holder.
2. Deposit one electrode (melting time of rod only).
3. Clean and brush slag from weld.
4. Relocate for next position.

Welding Current—Time studies per deposited electrode for different ampere readings were made, and the time required to deposit one electrode was plotted. (See Figure 1.) The result was a curve looking similar to part of a parabola. If the current strength used goes below a certain reading, time to deposit one electrode will increase rapidly, whereas above a certain reading time to deposit will increase slowly. When proper current strength is used, the fluid coating will form a wall across the deposited metal about 3/16 to ¼ in. behind the arc. The action of this wall and its distance behind the arc constitute a guide for determining whether the proper current is used.

Ratio of Metal Deposited per Electrode—If the correct welding current is used, the operator is able to deposit a fixed number of inches of the total length of the electrode used. The fixed number of inches of rod deposited divided by the total length of the electrode will give the deposit ratio of the electrode. In addition to the loss of the stub end of the electrode, there will be a slight loss of metal due to spatter. Since this loss is very small, it was not considered.

In setting the current strength at the proper point, the operator should work to his best advantage. Greatly increased current strength, due to overheating of the stub end of the electrode, decreases the deposit ratio which, in turn, means additional time lost for placing a new electrode in the holder. That is, the operator loses in additional handling time part of the saving in decreased welding time.

Weight (Size) of Weld Deposited—The weight of weld to be deposited can be determined by calculating the volume of metal deposited in cubic inches and multiplying the result by the factor 0.284. (Weight of one cubic inch of steel = 0.284 lb.) When calculating the number of electrodes per pound, figure the actual weight of the electrodes but do not include the weight of the coating. Remove the coating.

Oversize Allowance per Inch of Weld—Since time allowances are based upon the amount of metal deposited for a given size of weld, a reasonable oversize allowance was made to compensate the welder for irregularities of the base metal. The amount of oversize allowance depends entirely on the shape or type of the welded structure.

The percentage of allowance will be greater for small than for larger welds. For example, a 40 per cent oversize allowance for a 3/16-in. fillet weld increases the volume of metal to approximately 11/16 inch.

Number of Layers of Weld Deposited—Larger welds are made in a series of layers until the required size is obtained. This procedure is followed in order to relieve contracting strains and take out internal stresses; in fact, each layer refines the layer beneath it. It may be claimed that it takes longer to put down a large-sized weld in several layers than in one layer, but since time allowances are based upon the amount of metal deposited, the number of layers of weld were not considered in the rate calculations because the same number of electrodes will be used in either case. If it should be required to use different-sized electrodes to build up a weld, separate calculations would be made to obtain the time allowed.

The general procedure for calculating arc welding time per inch of weld, in decimal hours is:

1. Select from time studies the total time allowed per electrode at the proper current strength.
2. Determine the weight of metal deposited per electrode at a calculated deposit ratio.
3. Calculate weight of weld per linear inch in pounds and add the proper oversize allowance.
4. Calculate the number of inches of weld obtained from one electrode, for different sizes of weld.
5. Determine the time allowed per linear inch of welded seam.

•

Example 1.

To calculate welding time for fillet welds

(See Figure 2)

Welding rods selected: 5/32-in. diameter x 14 in. coated electrode, 13.2 rods per lb., not including coating; and 3/16-in. diameter x 18 in. coated electrode, 7.05 rods per lb., not including coating.

1. Select from time studies the total time allowed per electrode at the proper current strength (see Figure 1) and calculate the number of electrodes per pound, not including coating.

Selected time in decimal hours per electrode:

Operation	Size of Electrode, In. 5/32 Dec.Hr.	3/16 Dec.Hr.
Place electrode in holder and locate...	0.0019	0.0019
Deposit one electrode.....	0.0195	0.0307
Clean and brush off slag.....	0.0045	0.0046
Relocate for next position.....	0.0013	0.0029
Total time allowed.....	0.0272	0.0401

Size of Rod, In. Dia.	Length	Rods. per Lb.	Average Amp. Used	Time Allowed Per Rod, Dec.Hr.
5/32	14	13.2	170	0.0272
3/16	18	7.05	190	0.0401

2. Determine the weight of metal deposited per rod in pounds (2-in. stub end allowed). This is done by dividing the number of electrodes per pound into 1 and multiplying the result by the deposit ratio.

Size of Rod, In. Dia.	Length	Deposit Ratio Per Rod, Per Cent	Metal Deposited Per Rod, Lb.
5/32	14	86	0.065
3/16	18	89	0.126

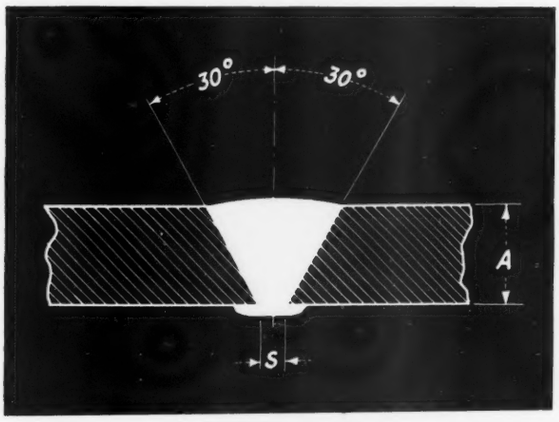


Figure 3. Butt weld. Example 2 shows how the time required to make these welds is calculated, assuming the use of 3/16- and ¼-in. coated electrodes

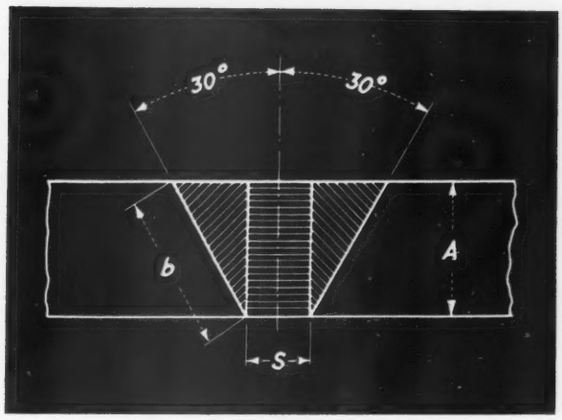


Figure 4. Volume of metal deposited in a butt weld is calculated by dividing the cross-sectional area of the weld into a rectangle and an equilateral triangle

3. Calculate the weight of fillet welds in pounds per inch of weld and add the proper oversize allowance. (1 cu. in. of steel = 0.284 lb.)

Size of Weld, In.	Weight of Weld Per In.-Lb.	Oversize Allowance Per Cent	Total Weight of Weld Per In.-Lb.
3/16	0.0050	40	0.007
¼	0.00883	35	0.0119
⅜	0.01992	35	0.0269
½	0.0354	30	0.0460
⅝	0.0553	25	0.0691
1	0.1418	10	0.1560

4. Calculate the number of inches of weld obtained per electrode. This is done by dividing the total weight per inch of weld (see 3) into the amount of metal deposited per electrode (see 2).

Size of Weld, In.	Inches of Weld per Electrode Size of Electrode, In. 5/32 x 14	3/16 x 18
3/16.....	9.3	....
¼.....	5.5	10.6
⅜.....	2.4	4.7
½.....	...	2.74
⅝.....	...	1.83
1.....	...	0.81

5. Determine the time allowed per linear inch of fillet weld, by dividing the number of inches obtained per

electrode (see 4) into the time allowed per electrode (see 1).

Size of Weld, In.	*Time Allowed per Lin. Inch of Weld, Dec. Hr. Size of Electrode, In.*	
	5/32 x 14	3/16 x 18
3/16	0.003	.....
1/4	0.005	0.004
3/8	0.011	0.009
1/2	.....	0.015
5/8	.....	0.022
1	.....	0.05

•

Example 2.

To calculate welding time for butt welds Clearances not to exceed A÷4 or 1/8-in. max. (See Figure 3)

Operation: Arc welding tank seams.

For first layers use 3/16-in. diameter x 18 in. coated electrode, 7.05 rods per pound, not including coating. Total time allowed per rod, 0.0401 hours.

For finishing layers use 1/4-in. diameter x 18 in. coated electrode, if wall thickness A is 1/2 in. or larger. 3.98 rods per pound, not including coating. Total time allowed per rod = 0.0524 hours.

For inside reinforced weld use 3/16-in. electrode.

Allow 1/4-in. weld if A = 5/16 in. or smaller; 5/16-in. weld if A = 3/8 or 7/16 in.; 3/8-in. weld if A = 1/2 in. or larger.

Rate calculations are the same as shown in Example 1 with the exception of the calculation of the amount of metal deposited.

To calculate the total volume of metal deposited, divide the cross-sectional area of a butt weld into one rectangular surface limited by A and S (Figure 4) and into one triangle with three equal sides having a 60-deg. angle.

S, A, and the angle of 60 deg. are known (S = 0.125).

In order to calculate the area of the triangle we must know b.

Cos 30 deg. = $A \div b$

$b = A \div \cos 30$ deg.

Cos 30 deg. = 0.866

Area of triangle, sq.in. = $(b \times A) \div 2$

Area of rectangle, sq.in. = $A \times S$

Total volume in cubic inches of metal deposited per inch of weld equals area of triangle plus area of rectangle.

Total weight in pounds of metal deposited equals cubic inches times 0.284.

The method of determining welding time described can be calculated for any size of electrode and, therefore, may be applied to suit any manufacturing condition.

After standards have been established correct welding time can be predetermined from drawings. The large table shows the time allowances in decimal hours per inch of seam on walls ranging from 1/4 to 3/4 in. in thickness.

Calculation of welding time by deposited electrode permits the welder to work according to specifications and to use the correct welding current, thus guaranteeing maximum efficiency of production.

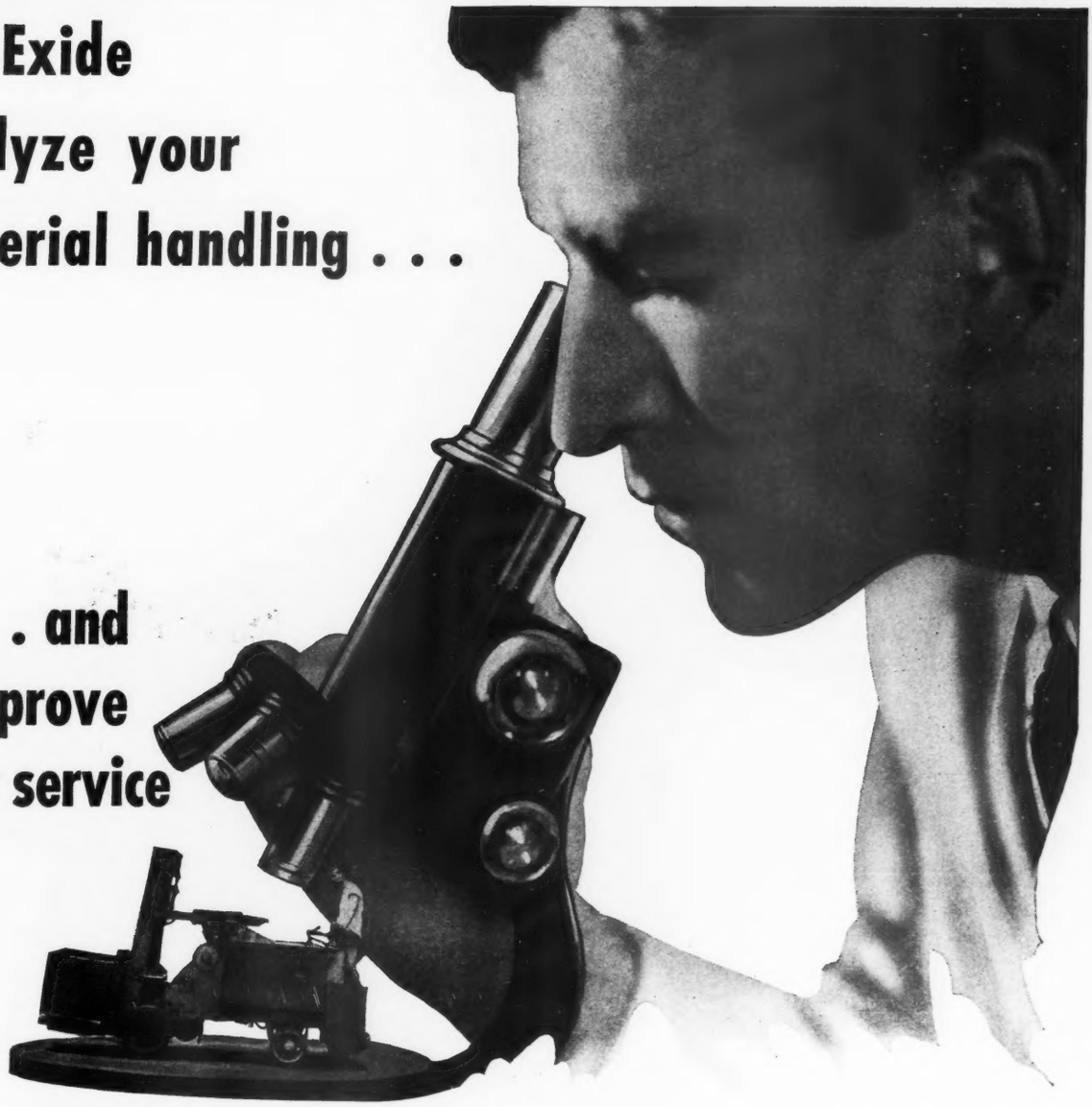
Time Allowed in Decimal Hours per Inch of Seam for Various Wall Thicknesses

Wall Thickness A	*Weight of Weld Per Inch, Lb.*		*Total Weight, Lb.*	*Metal Dep. Per Rod, Lb. Size of Rod, In.*		*No. of In. of Weld Obtained per Rod*		*Time Allowed per Inch of Weld* Outside		Inside	*Total Time Allowed Per In. of Seam Dec.Hr.*
	Rectangle	*Triangle*		3/16	1/4	3/16-in.	1/4-in.	3/16-in.	1/4-in.	3/16-in.	
1/4	0.0089	0.0103	0.0259	0.026	.....	4.9	.....	0.0082	.....	0.0038	0.012
5/16	0.0111	0.0160	0.0352	0.035	.....	3.6	.....	0.0111	.....	0.0038	0.0149
3/8	0.0133	0.0231	0.0473	0.047	.....	2.7	.....	0.0148	.....	0.006	0.0208
7/16	0.0155	0.0314	0.061	0.061	.....	2.06	.....	0.0195	.....	0.006	0.0255
1/2	0.0178	0.041	0.0735	0.047	0.027	2.7	8.3	0.0148	0.0063	0.0085	0.0296
5/8	0.0222	0.064	0.1032	0.047	0.056	2.7	4.0	0.0148	0.0131	0.0085	0.0364
3/4	0.0266	0.0922	0.1365	0.047	0.09	2.7	2.5	0.0148	0.021	0.0085	0.0443

* Including oversize allowance.

FACTORY MANAGEMENT AND MAINTENANCE **DATA SHEET**

Let Exide analyze your material handling . . .



. . . and improve your service

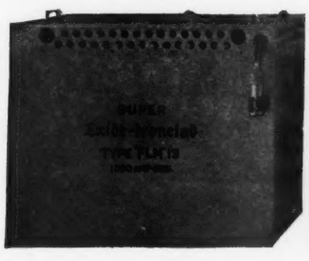
A CAREFUL analysis and study of the material handling jobs in your plant may show that a surprising improvement can be made in some of these handling jobs. Exide now has a testing unit and an odometer, which permit every material handling job to be analysed quickly and accurately.

A little black box is mounted on the truck for a day or two. From the recorded readings obtained, Exide engineers can determine just the size, capacity and number of battery cells required to enable the truck to do the best possible job under the particular conditions.

Why not let Exide make an analysis of your material handling job and a full written report of the findings? There is no obligation.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

To mark the fiftieth anniversary of Exide Batteries, a handsome souvenir booklet has been prepared illustrating the essential part these batteries play in daily life. Write, and we will gladly send you a free copy.



You want to know

and the editors will gladly tell you more about the things mentioned on this page

• SCRAPER gets old paint off in practically no time because it has a sawtooth edge on one side. After taking good bites with the teeth, the surface is smoothed down with the other side, a conventional ground edge. (10801)

• PAINT covers creosoted wood block floors with a seal through which pitch and creosote won't penetrate. It forms a dry, hard finish resistant to abrasion and impervious to oils. (10802)

• SOLDERING FLUX, non-corrosive, speeds up soldering of brass, tin, bronze, and copper. It's said to penetrate joints thoroughly and quickly. (10803)

• HAVE YOU a tax department or a tax specialist? Many companies have, according to an investigation made of the manner in which representative concerns are organizing and conducting their more-and-more-complex tax operations. (10804)

• NICKEL ALLOY has mechanical properties of high-strength alloy steels, yet retains the corrosion resistance of nickel. (10805)

• LIGHT DIFFUSER attaches to machine or bench light to give combination of direct and diffused lighting. (10806)

ANYTHING TYPED, written, printed, or drawn on a flat surface can be reproduced in three minutes on this machine. It makes waterproof, smudge-proof copies of letters, printed matter, photographs. (10823)

• FINISH for non-ferrous metals is said to have unusual power of adhesion. The coating is hard and non-yellowing, resistant to acids, alkalis, and alcohol. (10807)

• BECAUSE galvanized metal doesn't provide a good base for paint, there's a new cleaning and coating material that, applied, permits immediate painting of any zinc surface. (10808)

• SPRAY BOOTHS can now be cleaned with ease, thanks to a colloidal preparation sprayed on surfaces to be protected. After painting, dried accumulations can be peeled off in sheets like paper. (10809)

• GLOVES made of synthetic rubber can stand contact with gasoline, grease, acid, and caustics, foes of rubber gloves. (10810)

• SCOURING POWDER is spread evenly with a 30-inch-wide spreader you push along like a lawnmower. No dust arises, and controlled flow prevents waste. (10811)

• NEW WAGE DEMANDS and accelerated technological advance are probable consequences of the wage-hour law, according to a booklet which considers problems created by the act. (10812)

• TWO SOAPS, readily dispersible in water, can be applied in coating, filling, cleaning, and lubricating paper, textiles, rubber, wood, and other products. They dry quickly to form water-repellent films, and may also be used for waterproofing concrete, cement, and stucco. (10813)

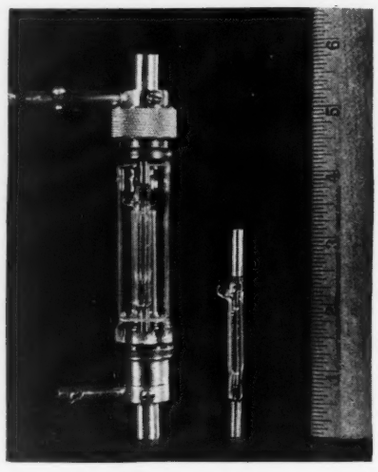
• MAGNIFYING GLASS with a 2x3¾-inch lens clamps to guide post to enlarge operator's view of fine work. A 15-watt lamp is inclosed in the same fixture as the lamp to give additional illumination. (10814)

• IF you really want to learn why so many salt tablet dispensers have appeared on the market of late, and why men working in hot locations are urged to take salt, read an article telling what salt does. Reprints are available. (10815)

• TIMER starts and stops heaters, fans, lights, and electrical appliances automatically. It watches over equipment, keeps it operating only so long as necessary. (10816)

• SLIDE RULE calculates weights of different metals in the famous jiffy. Given dimensions of steel, aluminum, cast iron, copper, bronze, and lead, weights from 0.1 to 10,000 lb. can be figured. (10817)

• SYSTEMS of shop management in the cotton-garment industry have been surveyed and findings published in a booklet. (10818)



NO LARGER than a cigarette, yet it's a 1,000-watt watercooled mercury lamp for use where an ultra brilliant light source is wanted. This steady, cool light is approximately twelve times as brilliant as the incandescent filament of a 1,000-watt lamp. (10824)

• ANOTHER SLIDE RULE simplifies calculation of profit possibilities in equipment purchases. Factors included in its workings are cost, increased production, hours of use per year, machine cost per hour, and life. (10819)

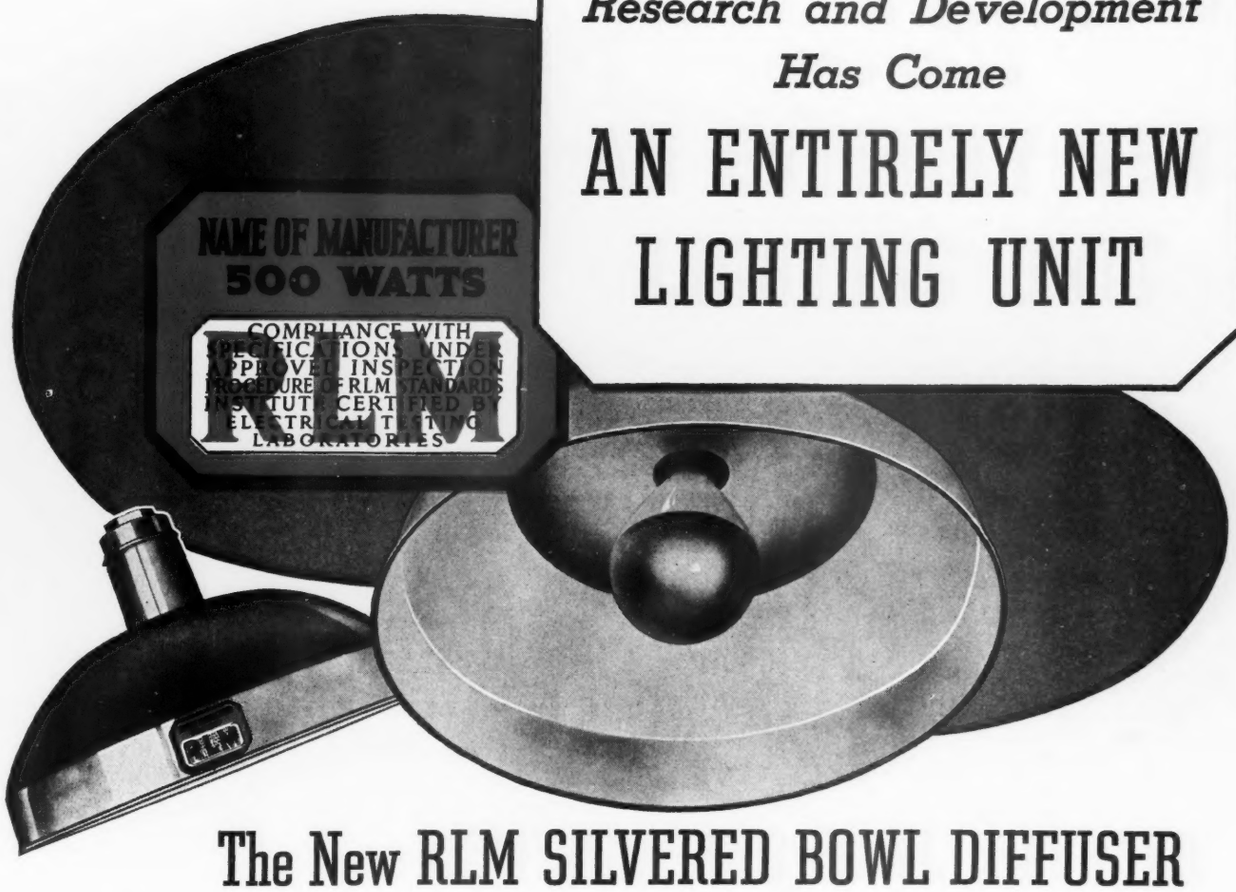
• BUYERS GUIDE on industrial lighting gives basic lighting factors and standards of efficiency, design, and quality of various types of reflectors. (10820)

• INDEX shows scope of industrial relations reference material assembled by a university bureau. Business men who cannot visit the library are invited to use the facilities through correspondence. (10821)

• COMPANIES celebrating anniversaries should have a booklet, "How to Plan for Your Anniversary," which tells how to start, find a theme, publicize the event. (10822)

Out of 18 Months of Research and Development Has Come

AN ENTIRELY NEW LIGHTING UNIT


NAME OF MANUFACTURER
500 WATTS
COMPLIANCE WITH SPECIFICATIONS UNDER APPROVED INSPECTION PROCEDURE OF RLM STANDARDS INSTITUTE, CERTIFIED BY ELECTRICAL TESTING LABORATORIES
RLM

The New RLM SILVERED BOWL DIFFUSER

The new RLM Silvered Bowl Diffuser marks another forward step in the science of Industrial Light Conditioning. Jointly developed by the Mazda Lamp Manufacturers and the members of the RLM STANDARDS INSTITUTE, this new unit is the *first to fully utilize the distinctive indirect lighting properties* of the Silvered Bowl Mazda Lamp and yet retain a high degree of light utilization.

In the RLM Silvered Bowl Diffuser, the only light source visible in the normal field of view is the low brightness portion of the porcelain enamel reflecting surface. The direct light from the lamp itself is shielded from view by its silvered bowl. Thus installations of these units produce a light which is particularly pleasing and comfortable to the eye.

RLM Silvered Bowl Diffusers, attested to by the Electrical Testing Laboratories as conforming to RLM specifications, can be readily identified by the RLM Label. Further information may be secured from your electrical wholesaler or any member of the Institute. Names of members as well as copies of the RLM specifications for RLM SILVERED BOWL DIFFUSERS, RLM DOME, RLM DEEP BOWL and RLM SYMMETRICAL ANGLE REFLECTORS may be had by addressing the Institute.

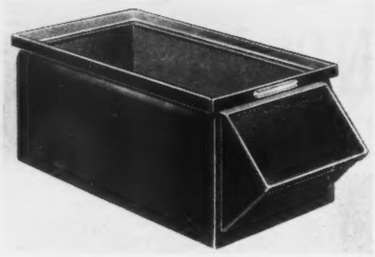
The letters RLM stand for Reflector and Lighting Equipment Manufacturers

RLM STANDARDS INSTITUTE
INCORPORATED

20 N. WACKER DRIVE · SUITE 1130 · CHICAGO, ILL.

THE CERTIFICATE OF RLM UNIFORM QUALITY

What's New in Equipment



Stacking Box

Stacking boxes and stack units of steel, for handling and storing all types of small parts, have been improved with a formed stacking rim around top of each unit. This rim allows boxes to be built safely into stacks without danger of tipping or telescoping. Corners are reinforced with steel angles that are locked and welded into position under the hem at the top corners. These corners resist tendency to "open up" that occurs with ordinary band steel reinforcing. Another new feature is the bin-type front. The bin front is an integral part of the unit and offers a more comfortable grip for handling. All-Steel-Equip Co., Inc., Aurora, Ill.

Fans

"Unit Fans" are one-, two-, and three-fan units available in six sizes for vertical or horizontal air discharge. They are designed to provide year-round ventilation and air circulation. They may also be used with controls and heating coils as recirculators and boosters for central air conditioning systems. When equipped with filter box and filters they are a compact unit for cleaning air. They are long and narrow and require little headroom for either vertical or horizontal installation. Fans are of the double-inlet centrifugal type. Motors are standard 220-volt, 3-phase, 60-cycle, size depending on speed, static pressure, and fan capacities required. Carrier Corp., Syracuse, N. Y.

Lighting Unit

"Silvered Bowl" diffuser is a lighting reflector designed to utilize indirect lighting characteristics of silvered-bowl Mazda lamps. Three elements are the lamp, porcelain-enameled reflecting surface, and an Alzak aluminum reflector insert. Aluminum reflector is located in top of the unit and redirects light from silvered-bowl lamp downward and outward. The aluminum surface produces light zone of high intensity, which is softened and diffused by action of the porcelain-enameled reflecting surface. Available in Socket Reflector and Turnlox type of hood construction. Benjamin Electric Mfg. Co., Des Plaines, Ill.

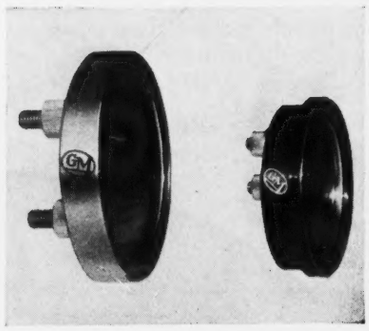
Battery Cell Filler

Type LV "Exide Water Cell Filler" speeds up work of adding water to batteries, at the same time permitting the job to be done without overfilling the cells. Consists of molded semi-hard rubber nozzle with a set of electric contacts and a filler pipe molded in. A handle is mounted on the filler pipe and behind the handle is a hand-operated valve to which is connected the rubber hose leading to

the source of water supply. Signaling device can be either a lamp or buzzer mounted on the handle, and the current can come either from the battery being filled or from a separate dry battery. Made in two lengths, 14 and 21 in., to provide for varying headroom conditions. The Electric Storage Battery Co., Allegheny Ave. & 19th St., Philadelphia.

Tank Flanges

"Unitank Flange" is a connecting unit whereby pipes can be connected to either inside or outside of a tank. Consists of only two parts. The flange body, tapped both ends and threaded outside, is inserted through a hole of the proper size from the inside of the tank; the outside piece, similar to an eight-sided nut with one face flanged out and finished, is attached by means of a left-hand thread. Also available is the "Unitank Flange Cutter," a special cutting tool to cut openings in tanks for these flanges. It is simple to operate and will cut holes in metal up to 3/16 in. thick. The flange is available in pipe sizes from ½ to 8 in. American Pipe & Steel Corp., 230 Date Ave., Alhambra, Calif.



Photoelectric Cell

Two barrier-type photocells have high output. Type F2A has a non-tarnishable metal case, while type F3 has a molded plastic case. Both cells can be supplied with visual filters to give them a color response. G-M Laboratories, Inc., Dept. NR, 1731 Belmont Ave., Chicago.

Fuse

"Trico-Matic" thermal time-lag fuse holds starting and momentary overloads, yet gives protection on prolonged overloads, making over-fusing unnecessary. Color indicator shows fuse size. There is also a flag indicator to tell when fuse is blown. Trico Fuse Mfg. Co., 5th St. at Chambers, Milwaukee.

Salt Tablet Dispenser

Salt tablet dispenser has knob at the bottom, which may be turned either way to release salt crystals. Transparent window shows when supply of tablets is running low. Grooves at back make it possible to slide on fasteners to attach to water cooler. Measures 7¾ in. high, with diameter at top 3⅝ in. Top unscrews for filling, and screws tightly shut to protect tablets from any contamination from the outside. International Salt Company, Inc., Scranton, Pa.

Blow Gun

Blow gun has sensitive control so that pressure may be controlled gradually from low to high and reverse. This saves air

"A.W." *Rolled Steel* FLOOR PLATE

The Super-Diamond Pattern of "A.W." Rolled Steel Floor Plate, illustrated, gives a completely safe tread from any angle, under any condition. Serves pedestrian and vehicular traffic with equal efficiency.

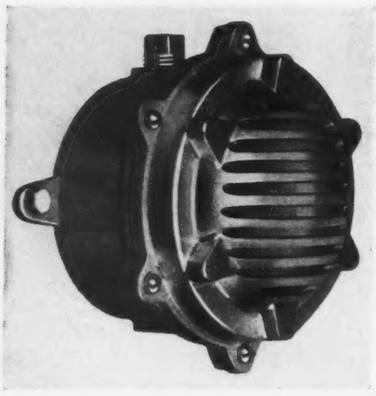
Traffic aisle, stair tread, runway, catwalk—for every vulnerable floor area, for every safety requirement, "A. W." Engineers have developed exactly the right type and weight of "A. W." Rolled Steel Floor Plate. Slip-proof. Heat-proof. Crack-proof. Easy to clean and quick to drain. Low first cost. No maintenance cost..."A. W." Floor Plate can be cut to any shape and installed almost over-night without disturbing production. Booklet showing five patterns and giving complete engineering data sent on request.

ALAN WOOD STEEL COMPANY

MAIN OFFICE AND MILLS, CONSHOHOCKEN, PENNSYLVANIA :: SINCE 1826 :: DISTRICT OFFICES AND REPRESENTATIVES—Philadelphia, New York, Boston, Detroit, Los Angeles, Seattle, San Francisco, Houston, Buffalo, Pittsburgh, Cleveland, Chicago, Cincinnati, New Orleans, St. Paul, St. Louis, Montreal. PRODUCTS INCLUDE—"A.W." Rolled Steel Floor Plates :: "Swede" Pig Iron :: Billets—Blooms and Slabs :: Sheared Steel Plates :: Hot Rolled and Hot Rolled Annealed Sheets and Strip :: Steel Products also furnished in Copper and Alloy analyses.

and eliminates hose kinking which some molders resort to to cut down pressure. There are no springs, and it is simple to take apart and clean. Valves may be removed by simply taking out the retaining ring. Nozzle is at 45-deg. angle, and there is a hook with which to hang it. Made of heat-treated aluminum alloy with retaining clip and button of bronze. James E. Mortimore, 72 Broadmere Road, Stratford, Conn.

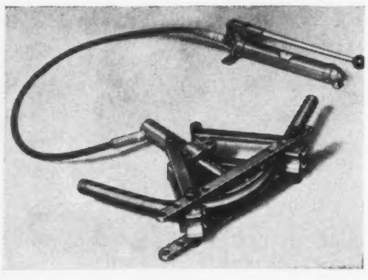
Horns



Weatherproof and watertight vibratory horns are powerful units giving loud signals. The No. 31 A. C. type uses no contacts; No. 41 D. C. type has tungsten contacts protected against arcing by a condenser. Both types operate on 110 volts. Federal Electric Co., 8716 South State St., Chicago.

Pipe Bender

"Porto-Power," a portable hydraulic unit, has been adapted to pipe and conduit bending and general maintenance work. The 10-ton capacity ram is separated from the pump by a 6-ft. high-pressure hose. Ram is equipped with threads in three places to which tools can be attached for different types of work. This design permits ram to work in all directions. One of the attachments



in the maintenance assortment is the pipe bender which operates in any position. It is light in weight, portable. Bends or straightens standard steel conduit, tubes, and pipe with 1, 1¼, 1½ and 2 in. diameters. Blackhawk Mfg. Co., Milwaukee.

Washfountain Sprayheads

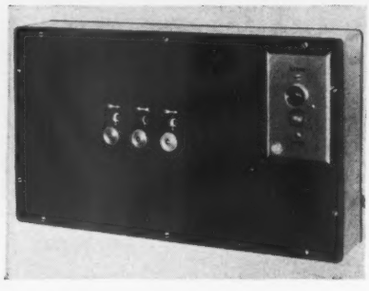
Design of self-cleaning sprayheads makes it possible to flush or brush out lime deposits and other foreign matter by merely separating the two parts of the head at the perforations. Consist of three main members, body, removable ring, and renewable valve seat, all constructed of heavy brass with exposed surfaces chromium plated. Bradley Washfountain Co., Milwaukee.

Centrifugal Pumps

Type HBD single-stage, side-suction centrifugal pump is a heavy-duty design. Sizes range from 1½ to 18 in. discharge; capacities from 10 to 15,000 g.p.m.; heads up to 300 ft. in the smaller sizes. Impeller is inclosed type, cast in one piece; pump casing of solid volute type with removable suction heads. Eccentric nozzle on suction head permits removal without disturbing discharge pipe or pump alignment. Pump casing can be furnished in special alloys for handling corrosive liquids. Impeller can be had in cast iron, bronze, or special alloys. Shaft is supported by two heavy-duty, double-row ball bearings. Lawrence Pump & Engine Co., P. O. Box 70, Lawrence, Mass.

Counter

Predetermined counting device can be set to record given number of cases passing over a conveyor line. When an order calls for a certain number of cases to be shipped, the device can be set for that number and will automatically stop the conveyor when these units have passed a given point. The recording mechanism can be placed in any location. A bell or



light signal is located where boxes are being dispatched. This signal is connected electrically with the counting device and indicates when run is completed. When the last case passes the mechanism, the device automatically shuts off power on the conveyor, and it cannot be started again except at the counter box. Standard Conveyor Co., North St. Paul, Minn.

pH Equipment

"Automatic Glass Electrode pH Equipment" consists of three units: an amplifier and cell chain, housed together; a power pack; and any one of several standard recorder-controllers. Each unit is contained in a strong, fume-proof case and shielded so that humid or chemical-laden atmosphere will not cause deterioration of the instruments or affect their operation. Cell chain assembly comprises an enameled metal case in which are mounted glass and reference electrodes. The cell is capable of handling both clear solutions and heavy suspensions. Is said to be sensitive to approximately 0.02 pH and accurate to 0.05 pH. Coleman Electric Co., Inc., 310 Madison St., Maywood, Ill.

Wrench

No. B-21 "Measurrench" measures right-hand turning torque so that proper loads may be applied to hollow screws. It is designed to enable the operator to avoid injury to screws and socket bits by over-tightening. Calibrated with numbers corresponding to numbers of various size bits which it accommodates. For hollow screws having 1/8- to 5/16-in. hex drive-opening. J. H. Williams & Co., 75 Spring St., New York.

Lighting Unit

"Projector" lamp embodies a precisely pressed glass reflector and a light-redirecting cover lens as part of a funnel-shaped glass bulb. Two types of cover lenses

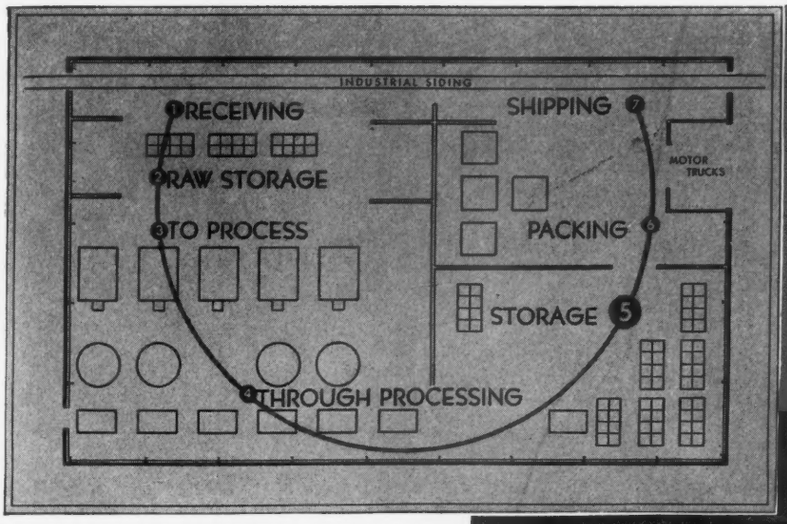
are available, one giving a wide-spread beam for general floodlighting, the other providing a powerful narrow beam for spotlighting application. A 150-watt filament is used, and a medium screw base fits ordinary sockets. Constructed of heat-resisting glass, the bulb permits tight fusion of its reflector element and cover lens. General Electric Co., Nela Park, Cleveland.

Controller

"Program Controller" finds application wherever variable temperature control is required over any period of time. Any desired temperature program can be automatically carried through to completion without supervision. Consists of program units and a controller mounted integrally. To the temperature-control-setting pointer of the controller is attached an idler arm which rides on the edge of the contoured disk of the program unit. Program disk is rotated by a synchronous motor through a gear reduction. Contoured disk can be cut to any time cycle desired with any variation of temperature control. Wheelco Instruments Co., 1933 South Halsted St., Chicago.

Switches

Series 700 R "Thermoswitches" comes in three types. No. 700 RC, the cartridge type, may be inserted in any reamed hole $\frac{5}{8}$ in. diameter, $3\frac{3}{4}$ in. deep, with a slot cut to engage the boss at top of cartridge to hold switch during adjustment. No. 700 RS, square head type, threaded to fit into ½-in. fitting, is designed to control temperature of fluids under pressure.



EVEN CRAMPED STORAGE SPACE *Expands* TO DOUBLE... SOMETIMES TRIPLE

1. **Car to Receiving**
2. **Receiving to Storage**
3. **Storage to Process**
4. **Through Processing**
5. **Process into Storage**
6. **Storage to Packing**
7. **Packing into Car**

DELIVERING finished products into storage can either incur needless, costly waste, or can make warehousing one of your largest-saving operations.

This picture shows how wide, how long and how high these heavy loads can be stored *by one man* and one Elwell-Parker built for the job.

Warehousing by the Elwell-Parker System—correct Trucks and attachments and a specially-devised operating plan—makes full use of the length and width of the structure—and *also* its full height. Its cubic contents, in other words.

Elwell-Parker Trucks transport, then tier finished goods in big volume on skids or pallets clear up to the roof timbers.

The Pallet System was born of necessity for more space in existing buildings. Elwell-Parker continues to improve both the machines and the methods and has carried them to practically all industries where Boxes, Barrels, Bags and Bales can be adapted as standard containers and can be handled on pallets as unit loads.

How long since you analyzed your costs of load-handling at each of *your* vital points and compared those costs with the savings which Elwell-Parker modern methods and equipment will bring? An Elwell-Parker Engineer will help you reveal opportunities for large new savings.

The Elwell-Parker Electric Company, 4323 St. Clair Avenue, Cleveland, Ohio.

ELWELL-PARKER *Power Industrial* TRUCKS

ESTABLISHED 1893 • BUILDING POWER INDUSTRIAL TRUCKS SINCE 1906

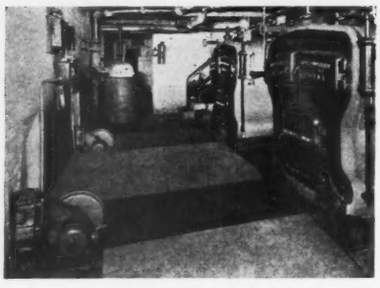
No. 700 RH, hex head type, is the same as square head type with the exception that it is chromium plated and provided with a flexible metal cable so that it can be used in exposed locations. These switches can be mounted in any position and can withstand rough handling. Current rating for non-inductive loads is 10 amp. at 110 volts, 5 amp. at 220 volts. Maximum temperature regulation recommended is 0 to 400 deg. F. Overshoot can be as great as 300 deg. F. providing that the top limit does not exceed 500 deg. F. Fenwal Incorporated, Ashland, Mass.

Shredding Machine

"Shred-Master" shreds waste paper and newspaper, converting it into packing material. It automatically interlaces and mixes the paper strands into a uniform fluffy mass. The resulting texture is light in weight. Texture may be changed by adjusting machine to cut strands from 1/32 in. up to any width desired. Kravan Machinery Corp., 51 East 42d St., New York.

Stoker

"Coal Flow" stoker is a bin-to-fire feed for boilers developing up to 300 hp. Coal is automatically conveyed direct to the fire from the main bunkers. All operating mechanism is located in the boiler room outside the coal bunkers. Stoker is electrically controlled, has full automatic



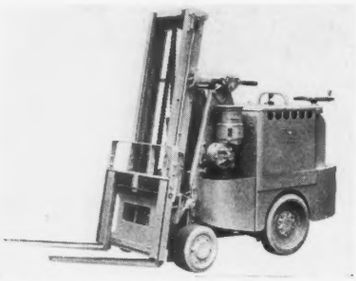
firing, maintains any desired steam pressure. Coal conveying section is available in lengths up to 20 ft., making stoker adaptable to practically any boiler room layout. Iron Fireman Mfg. Co., 4784 S. E. 17th Ave., Portland, Ore.

Recorder-Controllers

Line of recorders and recorder-controllers with 10- and 12-in. charts. Recording thermometer and pressure gage have interchangeable calibrated tube system that can be readily replaced and need be checked at one point only; stainless steel pen arm that can be removed easily for cleaning or replacement; precision-built capillary fountain pen designed with draftman's split-nib. Recording controller is offered in either "On-Off" or throttling control model. "On-Off" model fits all ordinary temperature control applications. The throttling model utilizes adjustable calibrated flapper which provides a sensitivity adjustment. This permits easy adjustment of the throttling range to coincide with any considerable apparatus lag. C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn.

Power Truck

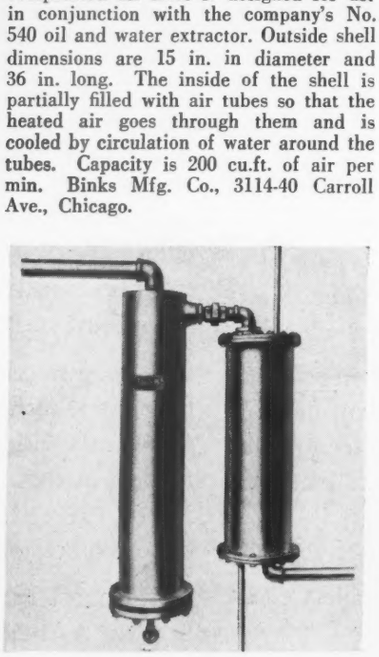
Type F-11 tiering, tilting, telescoping fork truck has rated capacities up to 5,000 lb. and four speeds forward and four reverse. Has two-wheel drive and four-wheel steer. Equipped with 500 per cent overload, heavy-duty, high-torque motor. Motor is direct connected to free-coasting worm and gear. Truck can travel over



uneven floors without transmitting strains to mechanism. Dynamic brake supplements the travel brake, and a solenoid brake on the hoist motor locks load in position unless released by the application of power. Regenerative braking supplements solenoid brake and returns current to battery when lowering load. A ratchet protects mechanism at bottom of down travel of load and an electric clutch protects mechanism at limit of up travel, and when overloaded. Forks stop automatically at either limit. The Elwell-Parker Electric Co., Cleveland.

Pre-Cooler for Air Lines

Pre-cooler for extracting moisture from compressed air lines is designed for use in conjunction with the company's No. 540 oil and water extractor. Outside shell dimensions are 15 in. in diameter and 36 in. long. The inside of the shell is partially filled with air tubes so that the heated air goes through them and is cooled by circulation of water around the tubes. Capacity is 200 cu.ft. of air per min. Binks Mfg. Co., 3114-40 Carroll Ave., Chicago.



Arc and Spot Welder

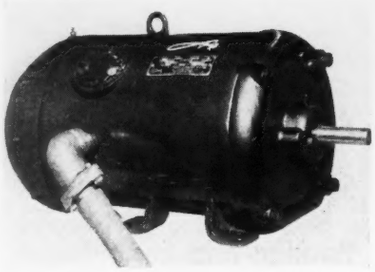
Combination arc and spot welder consists of spot welder built into the company's regular No. 2 and No. 3 welders, with capacities of 165 amp. for the No. 2 and 220 amp. for the No. 3. These units are of ample capacity to handle electrodes from 1/16 to ¼ in., and have 32 heat controls. The spot welder has a number of heat controls for different thicknesses of sheet metal. Miller Electric Mfg. Co., Appleton, Wis.

Cable Outlet Head

Type RC Conduit Cable Outlet Head uses a flanged cast iron conduit coupling, a non-magnetic cast aluminum plate with disk for grounding individual cable sheaths, and "Resistoyl" insulating fitting molded with a flange and two, three, or four tapered nipples. The nipples fit snugly to single-conductor, 600-volt cables up to 500,000 circ. mil. G&W Electric Specialty Co., Inc., 7780 Dante Ave., Chicago.

Motor

Line of d.c. explosion-proof motors are fan-cooled and are designed for use in Class 1, Group D explosive atmospheres, and are of rugged, heavily reinforced cast iron and steel construction. Available in wide range of both electrical and mechanical modifications. The Louis Allis Co., Milwaukee.



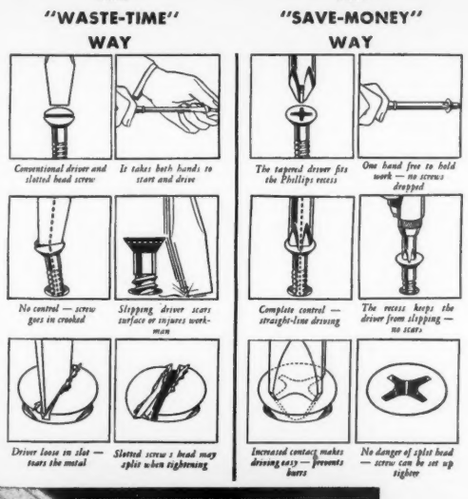
Pipe Joint Compound

Rockwood pipe joint compound can be used on all threaded pipe joints or gaskets on hot and cold water, gas, steam, compressed air, and vacuum lines. Lubricates threads while pipe joint is being made up and makes tight metal-to-metal joint. Surface hardens into protective skin that eliminates oil drops. Seals without cementing—compound beneath outer skin does not harden, thus permitting joint to be broken easily after long service. Rockwood Sprinkler Co., Worcester, Mass.

Fire Pump

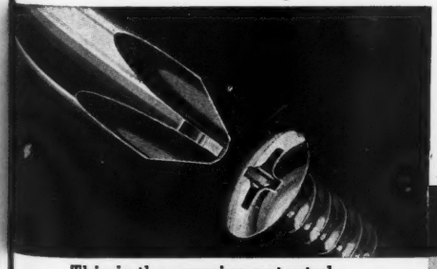
Fire pump is installed at the factory as part of the company's "Clarktor-6" tractor. This centrifugal pump can handle any kind of water regardless of dirt. Small high-pressure nozzle creates a fine mist at end of the water stream. Floating, flexible drive between motor and pump is provided by a power take-off. Automatic primer keeps pump primed by means of a vacuum from the motor intake manifold. When taking supply through a 4-in. suction opening from a 30-lb. hydrant, the pump will deliver 400 gal. per min. at 120 lb. pressure with motor running at 1,800 r.p.m. Pump is installed on front end of the tractor behind the bumper

Now it's safe to go fast where it *was* risky even to go slow. Phillips Recessed Head Screws end danger of accidents from slipping drivers — so faster driving methods are safe — and manufacturers cut assembly time up to as much as 50%!


THE "WASTE-TIME" WAY
THE "SAVE-MONEY" WAY
Conventional driver and slotted head screw
It takes both hands to start and drive
The tapered driver fits the Phillips recess
One hand free to hold work — no screws dropped
No control — screw goes in crooked
Slipping driver scars surface or injures workman
Complete control — straight-line driving
The recess keeps the driver from slipping — no scars
Driver loose in slot — tears the metal
Slotted screw's head may split when tightening
Increased contact makes driving easy — prevents burrs
No danger of split head — screw can be set up tighter

Using electric and pneumatic drivers to assemble parts already finished was *much too risky* before the Phillips Screw with its recessed head came along. Now there's no danger of the driver jumping from the screw and slashing a gouge across the finish — the tapered point of the Phillips Driver stays in the screw's tapered recess. One Phillips driver fits snugly a wide range of screw sizes.

RESULT: Fastening time reduced — in some cases up to 30 minutes of each assembly hour. Manufacturers report — "35% increase in assemblies per day" . . . "saves 50% in total assembly time" . . . "cost reduction much greater than anticipated, due to facility of driving by power" . . . "materially reduced our accident hazard" . . . "estimate operators save between 30 and 60% of their time" . . . "work spoilage eliminated." *It's cheaper to drive Phillips!*



This is the genuine patented Phillips recessed head

. . proven most successful for all types of industrial stening.

Note the tapered recess in the screw — its angle was rked out after months of tests to determine the most ficient form of recessed head, utilizing the driver's *maxi*um turning power. Note the flat surfaces — no curves cept at the rim. That prevents the driver from burring e screw. Cold forged to tolerances of plus or minus .001" to guarantee a perfect fit. 2 sizes of Phillips Drivers fit % of all screw sizes commonly used.

PHILLIPS RECESSED HEAD SCREWS

Gain Time . . . Guide-Driver . . . Guard Work

U. S. Patents on Product and Methods Nos. 2,046,343; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338
Other Domestic and Foreign Patents Allowed and Pending.

MACHINE SCREWS · SHEET METAL SCREWS · WOOD SCREWS · STOVE BOLTS

Manufactured by

American Screw Co., *Licensor*, Providence, R. I.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
National Screw & Mfg. Co., Cleveland, Ohio
Parker-Kalon Corp., New York, New York
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N.Y.

Send Coupon for FOLDER B — containing at least a dozen ways Phillips Screws can lower your assembly costs. (Address your inquiry to one of the firms listed above.)

Name.....

Company.....

Address.....

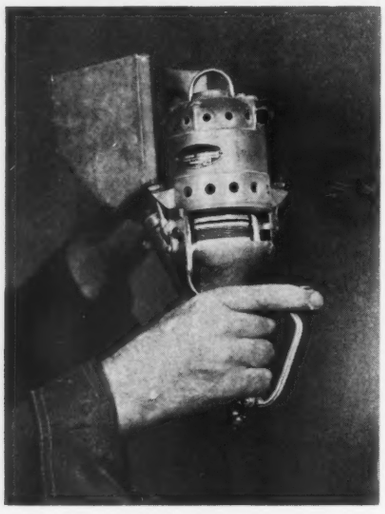
plate. Plate is lifted up out of the way and rests over the engine hood when pump is brought into action. Other uses for the outfit are for flushing out large areas, filling and draining tanks. Clark Tructractor, Battle Creek, Mich.

Hacksaw Blade

"A-Mol" hacksaw blades are of molybdenum steel. Come in all standard sizes, lengths, and widths for hand and power use. There are nine hand blades, 10 and 12 in., and of 18, 24 or 32 teeth to the inch. Power blades come in 32 different types ranging from 12 to 24 in. long, 1 to 2 in. wide, 4 to 14 teeth to the inch. E. C. Atkins & Co., 436 South Illinois Street, Indianapolis.

Painting Machine

Electric painting machine throws paint by centrifugal force in an even fan-shaped spray. Paint stream can be adjusted to widths from less than 1 in. up to 18 in. It is said to produce no paint fog, is capable of accurate control, and speedy. Consists of 1/10-hp. motor, gun, and 3-pint paint can. Plugs into any 110-volt a.c. or d.c. outlet. Weighs 5½ lb. Can be used for stenciling work, for applying solutions to fabrics, etc. Can also be used to apply waterproofing materials. Jas. H. Matthews & Co., 3942 Forbes St., Pittsburgh.



Wheel Puller

Three "Steel Grab Claws" have been added to the company's "Simplex Special Maintenance Set." These claws are used for pulling pinions, pulleys, bearings, collars, etc. Templeton Kenly & Co., 1020 South Central Ave., Chicago.

Welding Cable

"Clark Kickless Cable" is a water-cooled electrical connection between secondary taps of a welder transformer and a portable welder gun. Consists of central rubber core around which are helically wound, flexible, tinned copper cables. For alternate polarity, these cables

are separated by corrugated live rubber spacer, the whole encased in a flexible, wire and woven fabric reinforced, rubber tube. Interweaving of cables of alternate polarity with the corrugated rubber spacer causes reactances to neutralize each other, thus eliminating the "kick" or jerking apart of the cable. Construction permits circulation of cooling water in direct contact with the stranded copper cable, yet provides necessary flexibility. Comes in 4 sizes from 133,000 to 629,724 circ.mil. All sizes come in lengths from 3 to 12 ft. The Clark Controller Co., 1146 East 152d St., Cleveland.

Roller Conveyor

Impact-absorbing roller conveyor has each roller assembly mounted in a set of steel arms pivoting on a shaft extending through the arms and frame. There are two coil springs, one for each arm, attached at one end to this through shaft and at the other end to a shaft on the set of arms supporting the next roller assembly. When load carried on each roller assembly exceeds the rated capacity for which the assembly is set, excess load is transmitted to the coil springs. Because of the elimination of direct impact and shock, long life is claimed for the bearings and rollers. Standard Conveyor Co., North St. Paul, Minn.

Capacitors

Type JDF electrolytic capacitors for motors and other a.c. applications are hermetically sealed in aluminum containers. Are designed for applications such as motor starting during starting cycle of the motor, where high capacity is necessary for intermittent use, and for operation involving a maximum of 20 starts per hour, each start of 3 seconds duration. Cornell-Dubilier Electric Corp., South Plainfield, N. J.

Metal Coating Gun

Type E metallizing gun is intended for restoration of worn machine parts with various kinds of metals. It is also used for application of corrosion-resistant coatings. May be used as a hand tool for coating large structures or as a lathe tool for building up worn parts. Extremely fine coatings can be obtained with it, it is claimed. Has two complete speed ranges which cover all speeds necessary for commercial metals. Operates from acetylene tanks or generators at maximum recommended pressure of 15 lb. Air pressure required is 60 lb. Weighs 3¾ lb. Metallizing Engineering Co., Inc., 44 Whitehall St., New York.

Lighting Unit

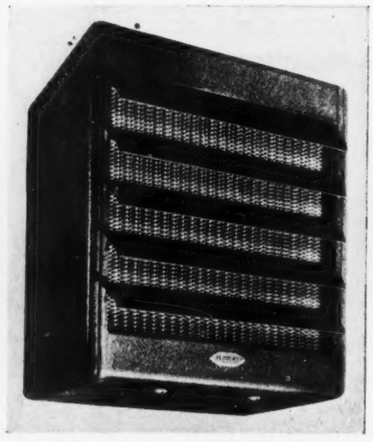
Angle-bracket-type explosion-proof fixtures for side wall mounting are suitable for hazardous locations in which flammable volatile liquids or other substances are manufactured or stored. This includes Class 1, Groups C and D locations. Brackets and lighting fixtures are designed with ample strength to withstand pressure of internal explosion and joints are flame-proof to prevent sparks and flames from escaping from the fixture. Available with porcelain-enameled steel reflectors in the company's Dome, Shallow Dome, Bowl and Symmetrical Angle shapes. Benjamin Electric Mfg. Co., Des Plaines, Ill.

Motor

Pivot-mounted, self-adjusting motor is designed for short center V or flat belt drives. Motor automatically keeps belt tension in proportion to the load and takes care of normal belt elongation without manual adjustment. Ball bearing equipped and quiet in operation. Motor construction is standard and mounted by means of a pivot. Pivot is mounted in bronze bushings and requires no adjustment. Burke Electric Co., Erie, Pa.

Unit Heaters

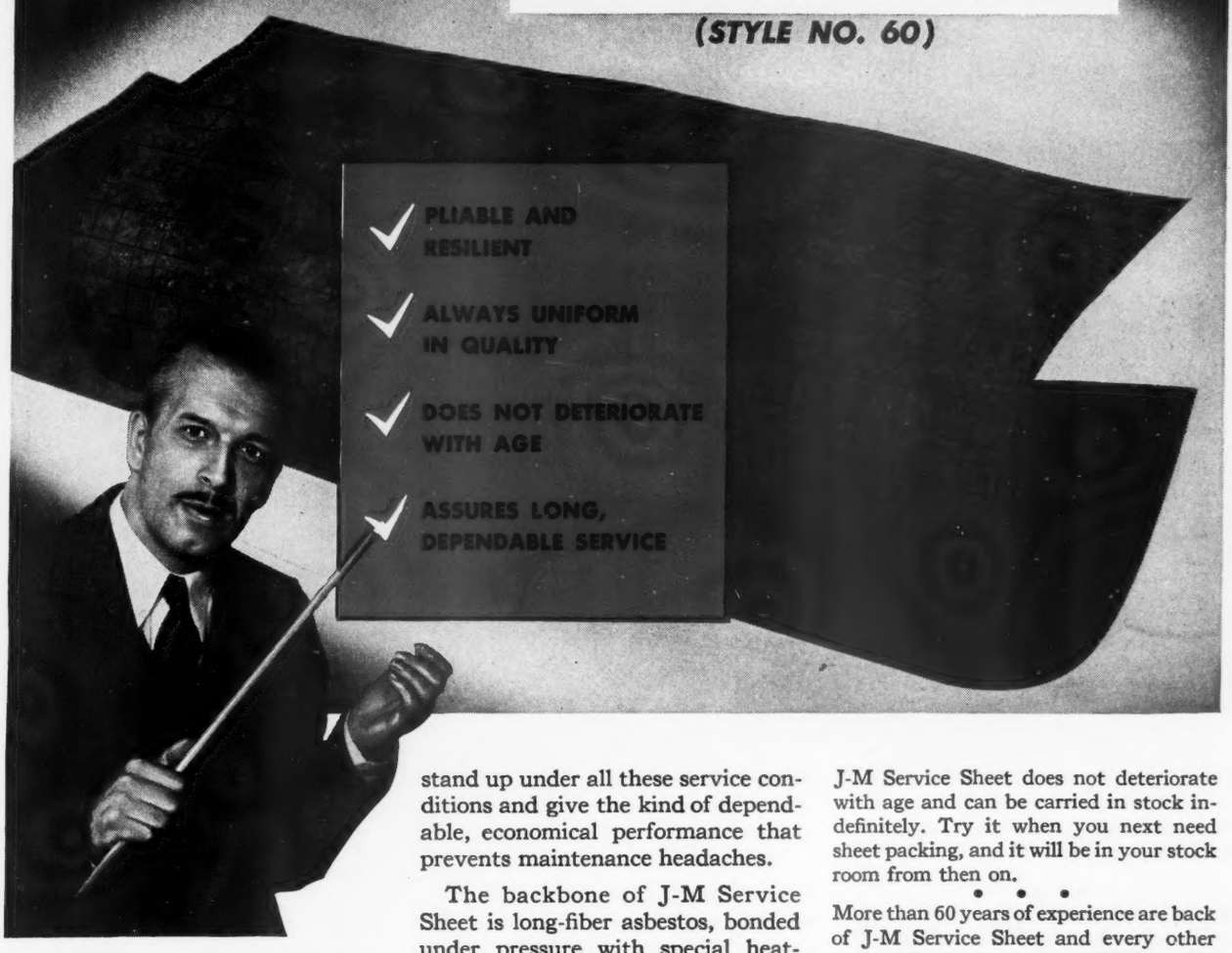
Series 4 unit heaters are available in 25 models ranging in capacities from 75 to 1,200 sq.ft. The fin surface is designed



"Here's a Sheet Packing you can count on!"

J-M SERVICE SHEET

(STYLE NO. 60)



WHERE do you use sheet packing? Against steam, gas, oil, air, water, ammonia, acids, alkalies or other chemicals?

Here's the asbestos sheet that will stand up under all these service conditions and give the kind of dependable, economical performance that prevents maintenance headaches.

The backbone of J-M Service Sheet is long-fiber asbestos, bonded under pressure with special heat-resisting compounds. It's pliable and resilient . . . always uniform in quality. One side is graphited; the other is ruled into one-inch squares to make measuring and cutting easy.

J-M Service Sheet does not deteriorate with age and can be carried in stock indefinitely. Try it when you next need sheet packing, and it will be in your stock room from then on.

• • •

More than 60 years of experience are back of J-M Service Sheet and every other packing in the *complete* J-M Line. No matter what your packing problem may be, you'll find the answer in the J-M Packing Catalog. Better keep a copy in your desk. Write Johns-Manville, 22 East 40th Street, New York City.

JOHNS-MANVILLE

PACKINGS & GASKETS *JUST PHONE YOUR NEAREST DISTRIBUTOR*

to reduce dirt and lint accumulation, and there are no horizontal areas anywhere in the fin surface. One-piece cabinet construction gives quiet operation, and there is a sound-deadening fabric between casing and fan shroud. Streamlined tubes and louvers offer low resistance to the air stream. Motors are mounted in rubber to isolate vibration. Motors for all current characteristics are available, including motors for operation under Class 1, Group D explosive conditions. Fedders Mfg. Co., Buffalo, N. Y.

Stacking Box

Steel stacking box has one-piece welded stacking rim and straight sides. Rim rests upon and is welded to sides of the box. It is made of 14-gage steel, double thickness, formed in one piece, and welded to make a solid rim which resists corner bending under heavy loads and rough handling. Safety feature lies in absence of sharp, broken corners. Stackbin Corp., 50 Troy St., Providence, R. I.

Steel Studs

One-piece metal wall stud is simple to erect and can be positively locked to floor and ceiling. Has channel side, large uniform openings, and reinforced X-shaped members, as well as an effective shoe and clip arrangement. For hollow-partition construction, the studs are furnished in stock lengths from 6 to 24 ft. Track is always in 10-ft. lengths. Made in six standard sizes from 2 to 6 in. Milcor Steel Co., Milwaukee.

Subway Switch

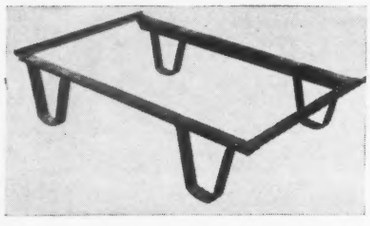
Type K subway oil switch with one-piece tank is rated 3-pole, 7500 volts, 200 and 400 amp. Has clip on position indicator plate and projection on the operating handle that prevents removal of the handle except when the switch is in open position. Only one handle is provided when two switches are used in a manhole for a double feed, and the interlocking device prevents closing one switch unless the other switch is open. G&W Electric Specialty Co., Inc., 7780 Dante Ave., Chicago.

Roofing

"Seal-Krimp" galvanized roofing has spring pressure lap and is said to be stormproof, weather-tight, and easily installed. Available in three grades of metal—copper-bearing steel, open-hearth steel, and ingot iron. When placed in position and nailed down, the sections are held firmly together with spring tension at three points. Drainage channels and siphon breakers are built-in features. The American Rolling Mill Co., Middletown, Ohio.

Skid Platform

"Re Nu Top" skid platform frames are intended for plants that have been making their own skid platforms of wood. The skid framework can be ordered in the size and capacity required; clearances range from 6½ to 12 in. Frame is shipped ready for installing the top which can be made by the plant's own carpenter from scrap lumber or lumber bought locally. Assembly is only a matter of dropping upper side angles in place, putting in bolts, and tightening the nuts. The Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia.

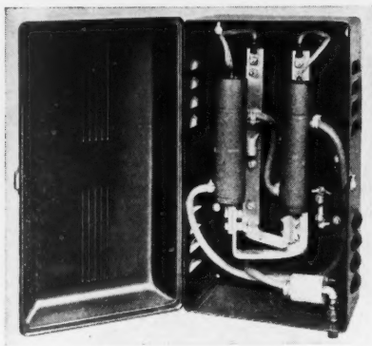


Meter

"Jumbo" volt-ohm-millammeters is 9 in. in diameter and has scale range of over 7 in. Scale is easily read at any angle and at a considerable distance. Has range of 0/10/50/250/500/2,500 a.c. and d.c. volts, 0/50 d.c. microamperes, 0/5/50/500 d.c. milliamperes, and resistance combinations up to 10 megohms. Blocking condenser is provided so that a.c. voltmeter may be used as output meter. The Hickok Electrical Instrument Co., Cleveland.

Welding Contactor

"Weld-O-Trol" electronic power switch, for controlling primary of welding transformers and suitable for use with existing timing devices, is an instantaneous switch for producing uniform welds. It has no moving parts or arcing contacts. Available ratings are roughly equivalent to 300- and 600-amp. welding contactors. Comes with either sealed-off or continuously pumped ignitron tubes. Electrical connections are one power cable entering the unit and one leaving it—the "Weld-O-Trol" acting as a single-pole, single-throw switch—and two control leads from the timer. A water flow relay insures adequate water pressure and actual flow of water through the ignitron tubes, and provides protection against either water failure or stoppage of the drain line. Westinghouse Electric & Mfg. Co., East Pittsburgh.



Stainless Steel Valves

Stainless steel valves are highly resistant to corrosion. It is claimed that the two alloys used, Cooper 18-8 S and Cooper 18-8 SMO, will take care of almost 90 per cent of all corrosion-resisting requirements. Other alloys can be had on special order. Available in seven styles: solid wedge or double disk gate valves, union bonnet or bolted bonnet regrinding globe or angle valves, and bolted bonnet "Y" valve. All are either screwed or flanged, in sizes ½ to 3 in. Jenkins Bros., 80 White St., New York.

Switch

Current control switch with 30-amp. capacity has ½-in. brass contacts molded into non-carbonizing molded plastic body. Fully inclosed construction reduces possibility of contact burning as oxygen is excluded from contacts. Single-unit type is 4 in. in outside diameter and has overall length from front of knob to back cover of switch of 2¼ in. Ganged type, for polyphase Y-connected circuits, has a 4-in. outside diameter and overall length of 5¼ in. Kneisley Electric Co., 16 South St. Clair St., Toledo, Ohio.

Wrench Set

Set of detachable "Supersocket" wrenches for use with hollow screws. Set is composed of bits, parts, and handles. Contains 19 pieces; 10 bits for handling hollow setscrews, ¼ to 1⅜ in. and hollow cap screws, No. 8 to 1 in.; and 9 handles and parts, including 2 reversible "Superratchet" handles and the No. B-21 "Measurrench," which measures right-hand turning torque. The bits have knurled ends for fast spinning of screws until they become tight enough to be turned with the driver. J. H. Williams & Co., 75 Spring St., New York.

IDEAS THAT *Clicked*

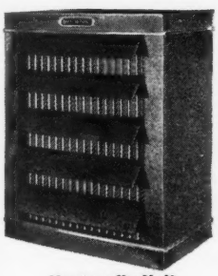
THE STEAM ENGINE IS INGENIOUS BUT INEFFICIENT WASTES TOO MUCH ENERGY
I'VE GOT AN IDEA FOR IMPROVING IT
I'VE GOT THE ANSWER! NOW I'M SURE I CAN BUILD A HIGH COMPRESSION INTERNAL COMBUSTION ENGINE THAT WILL WORK
LATER
THERE'S PROOF THAT MY IDEA WAS SOUND-THE DIESEL WORKS
I CAN'T BELIEVE MY EYES-IT'S RUNNING

1. An engineering student, Rudolph Diesel, got his idea for the present day Diesel engine at a thermodynamics lecture on the operating inefficiencies of the steam engine.

2. First, he proved his principle on paper. Then, set out to make it work. Strangely enough, he planned to use, not oil, but powdered coal as a fuel, to be ignited by high compression.

3. After years of effort, the idea was perfected and clicked. Oil proved a better fuel, but the Diesel revolutionized engine technique—won wide acclaim for its originator.

IDEAS THAT *Click* WITH HEATING BUYERS

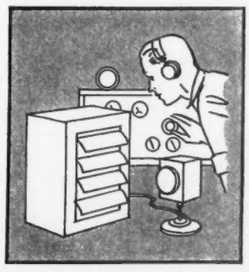


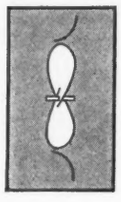
Venturafin Unit

High Velocity Venturafin—For Hard-to-Heat Plants—Has high outlet velocities and correct design for carrying heat long distances with minimum noise. Heats the working zone—not the ceiling.

Low Velocity Venturafin—For Smaller Areas — Is ideal for smaller areas and where quiet operation is essential. This unit has a low tip speed and low outlet velocity. No other heater duplicates its features and quiet operating qualities.

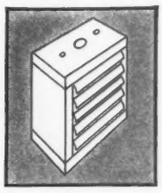
The Only Unit Heaters With Catalogued Sound Ratings—Only American Blower gives you catalogued sound ratings arrived at by thorough tests with extremely accurate sound recording equipment. This saves guesswork.

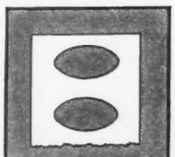




Streamlined Inlet—Here's an idea in design that saves you money—The accurately die formed streamlined inlet of American Blower Unit Heaters saves up to 35% in horsepower. This means important savings in operating costs.

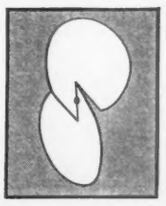
Individually Adjustable Louvres—Die formed logarithmic curved louvres permit you to deflect the heated air at any angle and control heat distribution



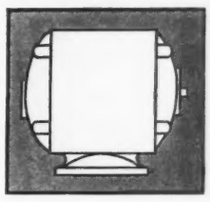


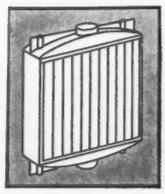
All Tubing Airfoil—Extra heavy Airfoil shaped seamless copper tubing gives maximum heat transfer, minimum air flow resistance, for operating economy and ruggedness.

Wide Area Blades—American Blower Units have the most efficient propeller fans we have been able to design—the result of over 57 years' experience. The famous wide area epicycloidal wheel is the quietest and most economical known in the industry.



All Motors Are Nationally Known Makes — Totally enclosed, with thrust combination, sleeve bearings and resilient mounted for quiet operation.





Cast Bronze Headers—Cast bronze "steam metal" used instead of pipe in coil headers costs us more but saves you money, gives units longer life.

For Heating Large Areas

SIROCCO UNIT HEATERS have proved invaluable for airplane hangars and large industrial areas requiring exceptionally large capacities. For complete data, phone or write the nearest American Blower Branch Office.

AMERICAN BLOWER CORPORATION
6000 Russell Street, Detroit, Michigan. Division of the American Radiator and Standard Sanitary Corporation • Canadian Sirocco Co., Ltd., Windsor, Ontario.

SEE THE NEAREST AMERICAN BLOWER ACCREDITED CONTRACTOR-DEALER FOR GUARANTEED INSTALLATION AND SERVICE

AMERICAN BLOWER

Industrial Unit Heaters Keep You Comfortable

Operating Shorts

That In-Between Snack

SOURCE, *Beech-Nut Packing Company Canajoharie, N. Y.*

Few plant managers deny the efficacy of the in-between snack. A sandwich or a banana or a bar of candy in the middle of the forenoon gives the factory employee just that extra zip that is needed to carry him or her through the morning till lunchtime comes around.

All of which raises a problem in some plants. It may be all right for the man who runs a machine in a metal-working plant to munch an apple on the side. But how about the man in, say, a food plant?

Beech-Nut recognizes this problem and gets around it very neatly by maintaining a cafeteria where any employee may go for the bite between meals.

This, by the way, is a "different" cafeteria. Most of the employees go home for lunch. There is free coffee in the cafeteria for those who come from surrounding towns and bring their lunches.

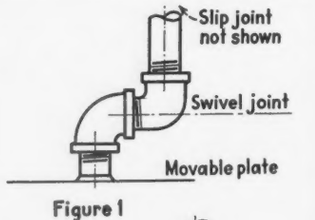


Figure 1

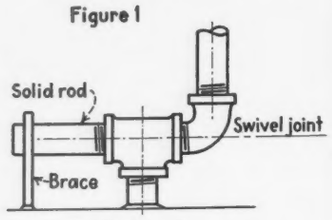


Figure 2

New Swivel Joint Cured Trouble with Hot Plates

C. A. LEE, *Evanston, Ill.*

Movable hot plates heated by low-pressure steam required a swivel joint acting in one direction.

A large number of plates were furnished with the joint shown in Figure 1. The steam connection consisted of a pipe with a street ell at the bottom serving as a swivel connection to the plate, and a trombone connection at the top with another swivel. As the plates were moved back and forth it was found that the elbow on the nipple would loosen up somewhat and get cocked; then the street ell would break.

This trouble was eventually solved by substituting a tee with an outboard brace for the other arrangement, as Figure 2 shows.

Place toe boards around edges of scaffolds and elevated platforms to keep tools from being kicked off onto heads of people below.

Pilot Plant Tests Steel Research

SOURCE, *Jones & Laughlin Steel Corporation, Pittsburgh*

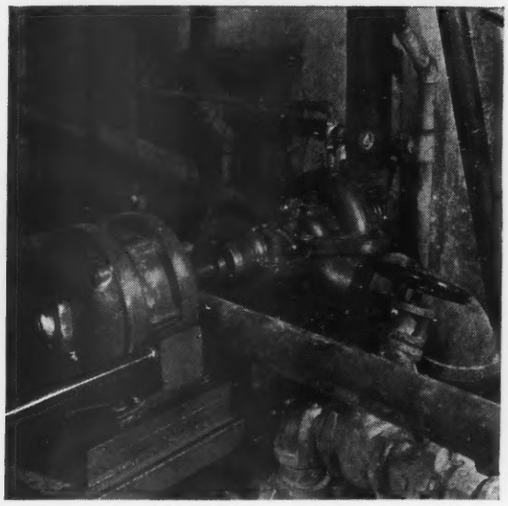
Through use of a miniature steel plant, the new research and development laboratory of Jones & Laughlin Steel Corporation puts results of laboratory research right to work, and tests them on small-scale mill production.

This pilot plant of small manufacturing units will be used to investigate various methods of steel making in a way that will make possible im-

SAVES $200 A MONTH IN 3-WAY SAVING!

Rieser Co., Inc., Replaces Old Pump with New, Modern Allis-Chalmers Pump! Saves Three Ways . . . On Power Bill . . . On Water Bill . . . On Product Reclaimed!

GET THE WHOLE STORY ON THE BIG SAVINGS ALLIS-CHALMERS CAN GET FOR YOU . . . WITH EQUIPMENT THAT PAYS FOR ITSELF!



THIS IS THE PUMP THAT IS GETTING a saving of $200 a month in the paper mill of the Rieser Co., Inc., Shamokin, Pa. The 3-way saving . . . in power, water, and reclaimed pulp . . . will more than cover the cost of the pump!

When your manufacturing process wastes some of your raw material, you'll try to reclaim that material if you possibly can! And when an Allis-Chalmers pump can help you do it . . . can get you savings in power and in water at the same time . . . you'll put it to work at once to get that three-way saving!

That's exactly what happened in the plant of the Rieser Co., Inc., paper manufacturers, at Shamokin, Pa. As in all paper mills, pulp is mixed with water, sprayed on an endless felt blanket, and processed into paper. The overflow from the blanket is picked up by a pump and raised to the "Save-All Screen" in the top of the mill where the pulp is then reclaimed.

But the old pump at the Rieser Co. . . . good enough some years ago, but now outdated . . . failed to deliver all the water to the "Save-All Screen." About 250 gpm of water and fine pulp was going down the sewer! That was a waste that had to be stopped! And it *was* stopped . . . with a new, modern Allis-Chalmers pump!

Doubles Amount of Pulp Reclaimed!

Actually, the amount of pulp reclaimed by the "Save-All Screen" has been doubled since the new pump was installed! But that isn't the only saving! The new pump is larger . . . but it uses no more power, pumping 700 gpm for the same cost as 450 gpm. No longer is water, bought from the local water company, wasted . . . it's all useable. And this three-way saving . . . power, water, reclaimed pulp . . . amounts to $200 a month . . . $2400 a year!

That's a real record of accomplishment! But it's not unusual at Allis-Chalmers! For in factories and in municipal pumping plants all over the country, Allis-Chalmers Centrifugal Pumps are piling up savings . . . savings that more than cover the cost of the pumps!

Get the whole story. Get the facts . . . and the figures! There's an Allis-Chalmers representative . . . a trained engineer . . . near you. Let him show you how to cut costs . . . how to save money with the equipment that pays for itself!

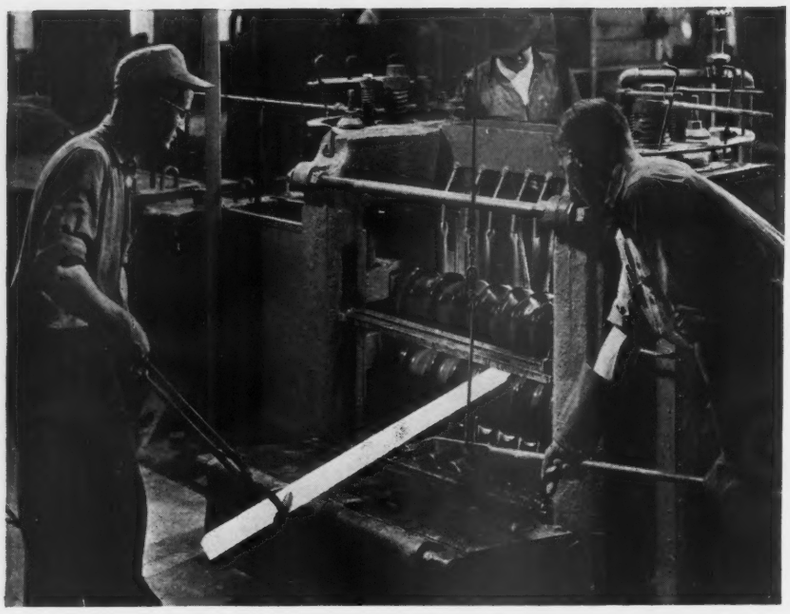
985

CENTRIFUGAL PUMP DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

SINGLE-STAGE DOUBLE-SUCTION PUMPS • CLOSE-COUPLED SINGLE-STAGE SSUnit PUMPS • MULTI-STAGE PUMPS • PAPER STOCK PUMPS • MIXED FLOW AND AXIAL FLOW PUMPS • AND SPECIAL DESIGNS FOR UNUSUAL APPLICATIONS



mediate application of new practices in the furnaces and mills of the production departments. Here an open-hearth furnace, heat-treating furnaces, and rolling mills of pilot-plant size are used in conjunction with chemical, physical, and metallographic laboratories.

A feature of this equipment is a small open-hearth furnace of 1,500 lb. capacity which parallels conditions in the big steel furnaces in the works. Ingots cast from this furnace weigh from 185 to 900 lb. as compared with ingots from commercial production which weigh from 3½ to 10 tons.

In addition to the open-hearth furnace, there is a 375-lb. electric arc furnace used for experiments on slags and steel making, a 30-lb. electric induction furnace which affords exacting control over experimental steel making. A cupola is available to supply molten iron for a small Bessemer converter which will be constructed later.

Two rolling mills are used in the laboratory, one for primary reduction of ingots, the other for further reducing bars into convenient sizes for test specimens. The larger mill is capable of reducing a 4-in. ingot to a 1-in. square. The smaller mill, which simulates conditions in a billet mill, will reduce a 1¼-in. square to a ½-in. square. A surface combustion furnace for billet heating, heat-treating furnace, small soaking pit, 500-lb. steam hammer, and welding machine complete the pilot plant equipment.

Products of the pilot plant are subjected to a variety of tests and investigations in the physical and metallographic laboratories. In these laboratories all manner of testing machines and devices are available.

Rack Adds to Convenience in Using A. C. Welding Set

CARL O. LANDRUM, *Dumont, N. J.*

About a year ago we purchased a small a.c. arc welding set, which soon became indispensable. For greater convenience in using it, we made certain additions to it, as shown in the illustrations.

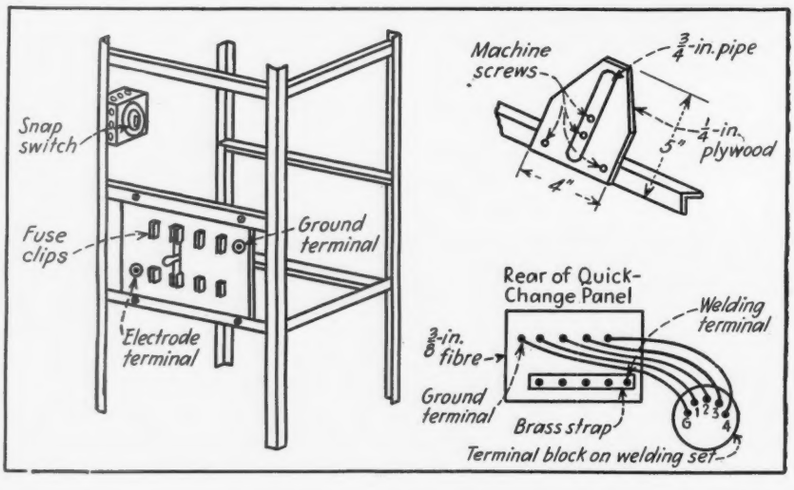
Originally, the outfit consisted mainly of the transformer and reactance case, on casters. The rack shown was made of 1x1x⅛-in. angle iron and was mounted on the case for easy removal. Welded construction was used throughout. The top extension of each upright provides a separate place to hang the helmet, and for draping the electrode cable, ground cable, and line cord without getting them tangled.

Delay of changing the electrode cable from one terminal to another for each heat was eliminated by building the quick-change panel. A piece of ⅜-in. fiber, 8x10 in., was drilled for mounting four pairs of 100-amp., rear-connected fuse clips and a through terminal bolt each for the ground and electrode cables. The detail drawing shows that ⅛x1-in. brass strap was used for the bottom clips and electrode terminal bolt; also, the connections from the terminal block of the welder to the top clips and ground terminal bolt.

A jumper for use between these clips was made of ⅛x1x5-in. brass fitted with the handle from an old belt shifter.

Above this panel will be seen a conveniently mounted 30-amp. snap switch for controlling the line circuit. The switch box is welded to the upright. The line cord goes into this box, and No. 12 BX cable carries the current from the switch to the set.

Two removable trays 1½ in. deep, made from 22-gage galvanized iron,



CRANE SCREWED FITTINGS FOR POWER PLANTS AND FACTORIES

Crane's line of fittings includes not merely the few hundred types and sizes in most common use, but a total of more than 10,000 separate and distinct items in cast and malleable iron.

ELBOWS—90°, 67½°, 60°, 45°, 30°, 22½°, 11¼°, and 5⅝°, Street, Long Sweep, Side Outlet, Drop, Hub Vent

TEES—Service, Four-Way, Drop Tees, Long Sweep, Double Sweep, Wash Tray

COUPLINGS—Right Hand, Right and Left, Half (Also Wrought Iron), Reducers, Increasers

BUSHINGS—Outside and Inside Hexagon, Face, Eccentric, Double Tapped

PLUGS—Square Head, Solid, Countersunk, Bar, Barrel

NIPPLES—Close, Short, Long, Tank

UNIONS—Gasket Type, Ground Joint, Female, Male and Female, Air-Pump

UNION FITTINGS—Male and Female, 90° and 45° Elbows, Tees with Union on Run or Outlet

A CRANE FITTING FOR EVERY PURPOSE—The screwed fittings shown above are only a few of the scores of different types and modifications. The complete Crane line includes banded and plain patterns, black or galvanized, in a wide range of straight and reducing sizes; in four pressure classes in malleable iron and five in cast iron.

99 9,996,551/10,000,000% OF CRANE SCREWED FITTINGS ARE FOUND FIT

Last year, out of the millions upon millions of Crane screwed fittings sold, only one in every 290,000 was reported unusable. Striking proof that—in fittings as in valves—

IT'S WHAT'S INSIDE THAT COUNTS!

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO, ILLINOIS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

were made to fit on the cross-members. These trays hold special fluxes, jigs, wire brushes, files, ointment, and so on. Across the back of the rack a ½-in. rod was provided for holding various sizes of C clamps.

For electrode holders U-shaped pieces of ¼-in. iron rod were formed around 2-in. pipe and welded to cross-members. Five of these pieces were fastened on each member, providing room for ten sizes and grades of rods. Sheet-metal channel pieces welded to the members form a bottom for these divisions. Small, 7½-in. rods for very light work are kept in a sheet-metal corner case.

To avoid accidental flashes and burns a safe place to keep the electrode holder is essential. The drawing shows how an insulated holder was made of ⅜-in. pipe and ¼-in. plywood, and mounted at the top of the rack.

For greater convenience in clamping the work a 3-in. C clamp was bolted to the end of the ground cable.

•

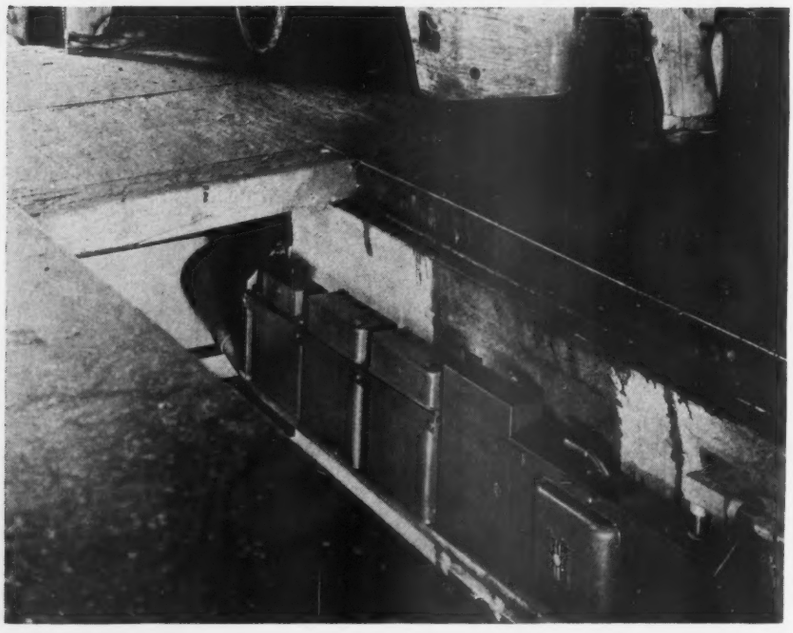
Capacitors Save Body Plant $1,200 A Month

SOURCE: *General Electric Company Schenectady, N. Y.*

A number of capacitors installed some months ago in one of the Detroit plants of The Murray Corporation of America have effected an average monthly saving of $1,200 in power costs—enough to pay the total cost of the equipment in less than a year.

The capacitors are located at 22 strategic points on various 440-volt power feeders. Inasmuch as no floor space was available, twelve equipments of 40-kva. capacity each were placed in existing service trenches beneath the main floor. Ten larger assemblies were suspended by ceiling hangers above the production area.

Two other units, rated 120 kva., 4,600 volts, were mounted outdoors near transformer banks supplying part of the plant with 220-volt energy.



Treating belts with a suspension of colloidal graphite in water will cause dissipation of static electrical charges. Graphite films formed on belts carry static charges from pulleys to the frames.

Check List for Preparing Plant Yard for Winter

S. H. COLEMAN, *Roanoke, Va.*

Before cold weather comes on certain precautions must be taken in almost every plant to prevent damage. Here are some questions that will serve as a convenient check list to prevent important items from being forgotten:

1. Have weeds, leaves, and rubbish that might constitute a fire hazard been removed from the yard and around fencing?

2. Are shrubbery, lawns, flower beds, and other landscaping properly protected against cold weather damage?

3. Has the water been cut off all outside water piping not used during the winter? Have these lines been thoroughly drained and all exposed valves left open?

4. Has all outside maintenance and repair work that can be done now been completed, so that personnel will not be unnecessarily exposed to severe weather?

5. Are exposed tanks, piping, outside fire protection equipment, and so on, adequately protected against freezing?

6. Has water been removed from the traps of outside plumbing and replaced with an anti-freeze solution, such as alcohol or calcium chloride, covered with a non-soluble oil to prevent evaporation?

7. Have water jackets, radiators, or other water-holding parts of idle equipment used, or stored, in the yard been drained?

8. Are water-containing parts of yard equipment which must be used during the cold months protected against freezing?

9. Will piles of materials which must be drawn upon during the winter be readily accessible in all kinds of weather?

10. Have low places in roadways and walks where water might collect and freeze been filled in or provided with proper drainage?

11. Are overhead electrical equipment and wiring in condition to withstand heavy coatings of sleet and snow?

12. Are snow plows and other snow removal equipment adequate and in good repair?

13. Have you considered snow-fencing as a cheap means of preventing drifts in parking spaces and across important roadways?

14. Have you taken steps to prevent damage from freezing in places where it has occurred during past years?

15. Have you carefully inspected the yard and all outside equipment to make sure that nothing has been overlooked?

•

Ruled Straight-edges Facilitate Drafting

JOHN A. HONEGGER, *Bloomfield, N. J.*

A small or medium-sized sketching or drafting board constructed as shown in the drawing is very handy in that vertical and horizontal dimensions can be laid out directly without the use of an additional scale. It is ideal for making graphs or charts of any kind.

It consists essentially of an ordinary board which has been recessed on the left-hand side to accommodate the

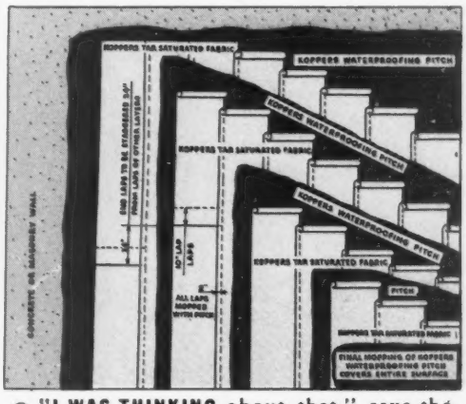
(*Continued on page 112*)

Costly experience Saves Money

FOR BLANK MANUFACTURING COMPANY

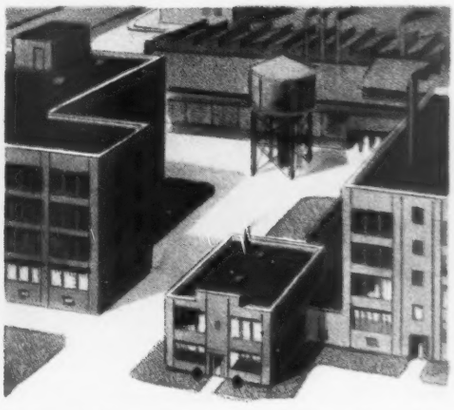
1 **BLANK MANUFACTURING COMPANY** has outgrown its plant and Jerome K. Green, president, is discussing plans for a new factory. Just then his maintenance engineer reports bad leaks in foundations of the old building.

2 **"THE OLD BUILDING** wasn't waterproofed," says the maintenance engineer, "If we stay here, we'll have to waterproof these foundations . . . you can guess what it will cost to dig up enough ground to get at them."

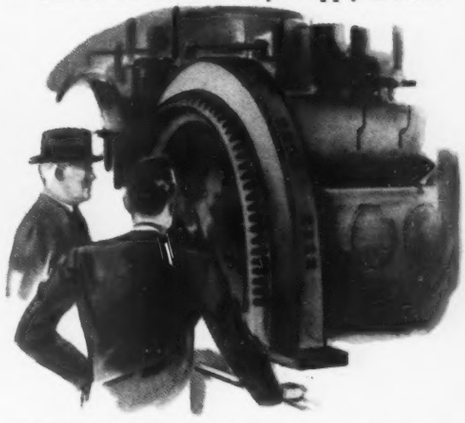

KOPPERS TAR SATURATED FABRIC
KOPPERS WATERPROOFING PITCH
KOPPERS TAR SATURATED FABRIC
KOPPERS WATERPROOFING PITCH
KOPPERS TAR SATURATED FABRIC
PITCH
FINAL MOPPING OF KOPPERS WATERPROOFING PITCH COVERS ENTIRE SURFACE
CONCRETE OR MASONRY WALL
ALL LAPS MOPPED WITH PITCH

3 **"I WAS THINKING** about that," says the architect. "Koppers Membrane Waterproofing applied to foundations will protect your new building against leaks . . . and cost less now than it will if you apply it later."

4 **"THIS IS GOING** to save us money," declares Mr. Green, as the waterproofing went on the new building. "There won't be a drop of water in our basements. We'll use the basements without worrying about water damage."



5 **MR. GREEN** was right. Blank Manufacturing Company's new plant has been in operation for several years now. There has been no maintenance expense on the foundations and never a trace of seepage trouble.



6 **ENGINE-ROOMS** in the basement are clean and dry. Operation is more efficient because absence of dampness has materially reduced the problem of keeping floors and machinery in good order.

KOPPERS PRODUCTS

Koppers Roofing . . . Waterproofing . . . Dampproofing . . . Bituminous-Base Paints . . . American Hammered Piston Rings . . . Fast's Self-aligning Couplings . . . Platework . . . Tanks . . . Cast Iron and Steel Pipe . . . Gas, Air, Water, Tar Valves . . . D-H-S Bronze Castings . . . Iron Castings . . . Western Fire Hydrants . . . Locomotive Packing . . . Creosote Oil . . . Treated Timber, Lumber and Piling . . . Materials-Handling Equipment . . . Tarmac Paving Materials . . . Coal . . . Coke . . . Gas . . . Disinfectants . . . Insecticides . . . Deodorants . . . Pipe . . . Weed Killers . . . Tar Acids . . . Light Oils . . . Naphthalene

Koppers Membrane Waterproofing should be applied to foundations of every new building where there is danger of seepage. Genuine Koppers Waterproofing Pitch, mopped on alternate plies of Koppers Tarred Fabric, forms a continuous waterproof blanket which keeps out moisture and water under head. And because it is a bituminous product, not affected by water and ordinary chemicals as they are found in the soil, Koppers Waterproofing is *permanent* waterproofing. Have a Koppers Waterproofing Engineer show you why waterproofing on *new* buildings saves money.

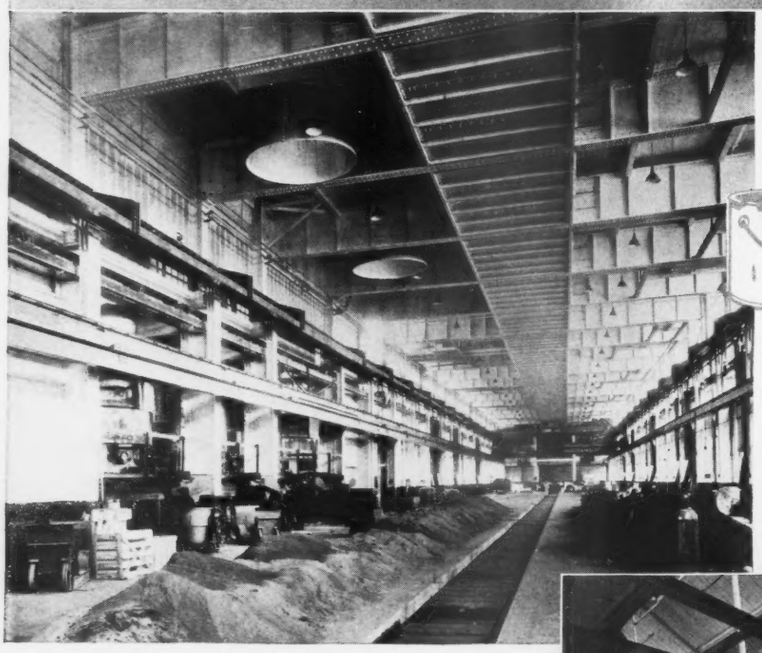
KOPPERS COMPANY, Tar and Chemical Division · Pittsburgh, Pa.

KOPPERS *Waterproofing*

a **KOPPERS** *product*

Industry sees better with

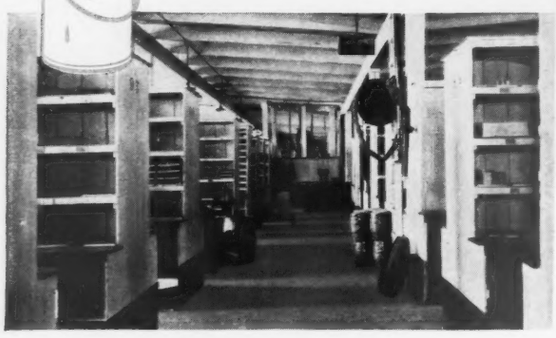
ALUMINUM PAINT



FOUNDRYMEN in this plant are better able to see their work by reason of the Aluminum-painted walls and beams, which distribute light uniformly around the room. Sulfur-containing gases do not darken or discolor Aluminum Paint.

60 TO 75 PER CENT of the total light falling on Aluminum-painted surfaces is reflected. Aluminum Paint has the merits of good one-coat coverage of dark surfaces and exceptional durability in industrial services.

LESS TIME IS WASTED hunting for materials when Aluminum Paint is used for bins and shelves in storerooms. Floor pits, carrying piping and conduit, are another good place for Aluminum Paint. Its brightness facilitates inspecting and repairing lines.

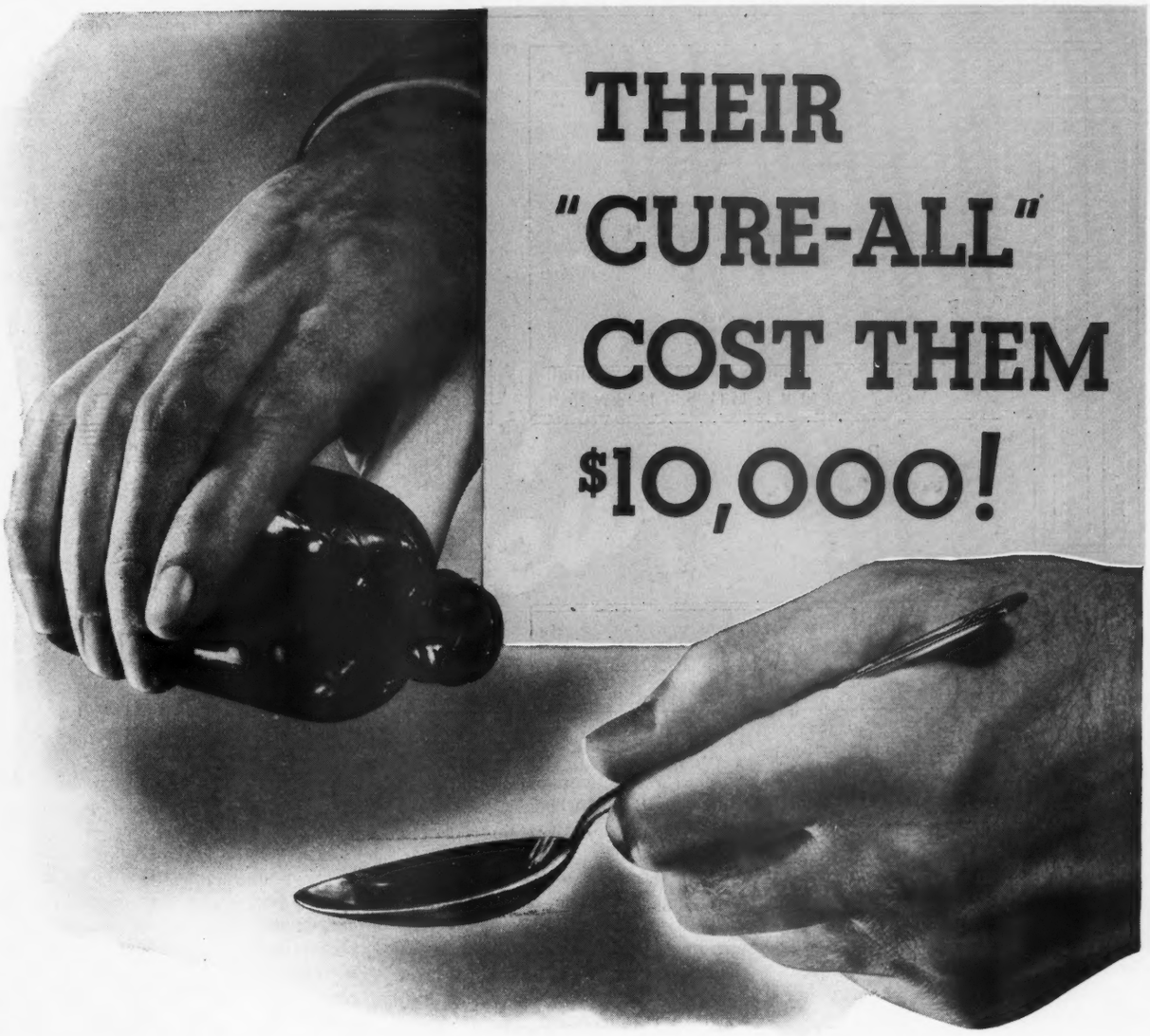


TECHNICAL DATA FREE. Formulas and specifications for the proper type of Aluminum Paint for all different surfaces and service conditions are given in the *Aluminum Paint Manual.* Every maintenance engineer should write for a copy.

Reg. U. S. Pat. Off.
ALCOA
ALUMINUM

ALBRON *Paste for* ALUMINUM PAINT

We make no Aluminum Paint; only Alcoa Albron Paste and Powder, the pure Aluminum pigments that you get from leading paint manufacturers with their own vehicles suited for different services. ALUMINUM COMPANY OF AMERICA, 2126 Gulf Building, Pittsburgh, Pennsylvania.



Read How Shell Engineers Solved This Coal Company's "Cure-All" Problem

THE G. & F. Coal Company of Brazil, Indiana, operates a number of strip coal mines in Clay County. Diesel-powered draglines and shovels produce about 3,000 tons daily.

At the height of their busy season —February, 1937—the company was prevailed upon to try a "cure-all" lubricant. This oil was "guaranteed" to end ring-sticking forever in their Diesels.

Six months' operating with this lubricant told the story. One by one, these engines went out of commission. Complete overhauling cost $1,000 per machine! Production fell off 50%! Orders amounting to $10,000 were lost!

Shell was called on to stem the tide of losses. Working with the G. & F. maintenance men, a complete survey of the engines was made. The answer was obvious. Not a "cure-all," but the proper Shell Diesel Lubricant for this type of equipment.

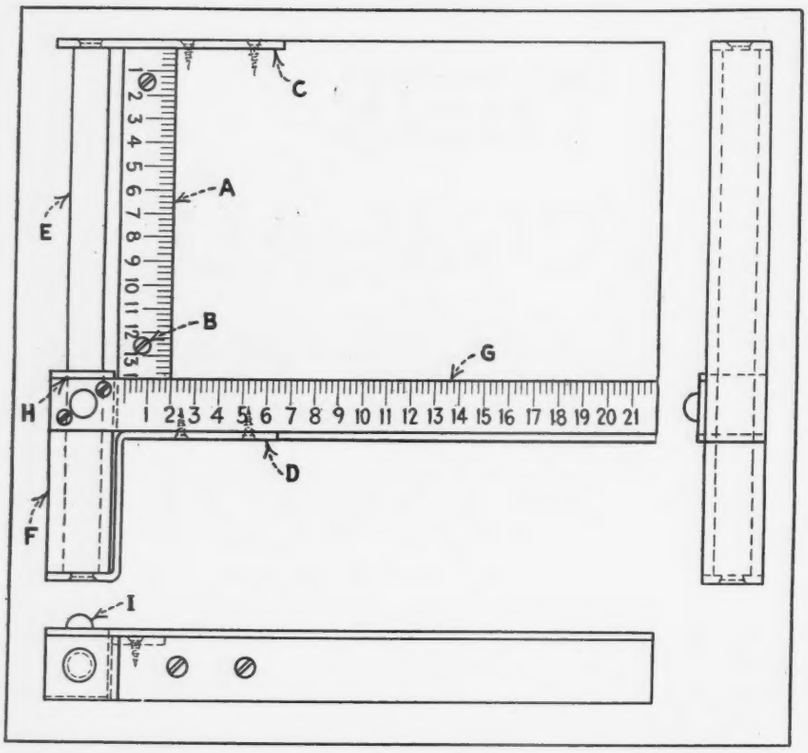
Results were immediate. Ring-sticking was reduced to a minimum. Production returned to normal and again orders were being filled on time.

• • •

In thousands of American mines, mills and factories, Shell men, working with Shell Lubricants, are achieving results like this. For Shell applies to your problem the ingenuity and resourcefulness gained from solving countless problems of industrial lubrication—and the finest lubricants being refined. This "plus" in lubrication is always available to you. Simply call or write your nearest Shell office.

SHELL

SHELL DIESEL LUBRICANTS



vertical scale, *A*. This scale is held in place by two screws, *B*. At the top and bottom of the board there are two other stepped recesses, to which are fastened straps *C* and *D*. Riveted into these straps is rod *E* upon which slides guide *F*. To this guide there is fastened the straight-edge scale, *G*. This straight-edge is rigidly fastened in slot *H* of guide *F*. Knob *I* is for convenience in sliding the straight-edge up and down.

For greater convenience this straight-edge should be made of transparent material so that lines or figures beneath it can readily be seen.

Report to New York State Medical Society states that fatigue is more responsible for accidents and reduced production than generally believed. More frequent rest periods and opportunities for changes in posture are suggested.

Automatic Welding Device Doubles Output

FRANK ELLWOOD, *Chicago*

A special order involved welding several thousand disks in pairs to form grooved wheels. Purchase of a special automatic welding machine was not warranted; therefore, an old lathe was adapted without much trouble for semi-automatic welding.

Each grooved wheel consisted of two duplicate disks stamped from light steel plate, with drawn, projecting hubs, the outer edge being dished in a quarter-circle to form one-half of the groove when the pair was welded together at the bottom of the groove. A shaft turned to form journals at the ends was forced into the stamped hubs by a press, since the wheel served merely as a supporting roller.

With the disks in position the shaft was placed between the centers on the old lathe, which was driven by a spare speed reducer and motor at a speed of approximately 1 r.p.m. for continuous welding.

The welding unit was mounted in the proper position in a fixture on the tool carriage and the welding wire feeding mechanism was also arranged to be driven by the lathe. While the unit was welding one pair of disks, the operator assembled the disks and shaft for another wheel. This outfit practically doubled the output of the operator, as compared with hand welding and rotation of the work.

It was also found useful on several other special jobs where circular welding was required, such as building up worn shafts.

•

Sulphur Pipe for Corrosive Liquids

ISAAC BENCOWITZ
Texas Gulf Sulphur Company
New York

Inertness of sulphur towards water and many acids and chemicals has led to its wide use as a jointing and sealing compound in the construction of floors, sewers, acid tanks, and so on.

Recently it has been cast in the form of pipe, and also used as a lining for steel pipe. The process is similar to that used in the production of centrifugally cast iron pipe, the apparatus consisting of a rotating, jacketed mold and a feeding mechanism. The mold is started cold and while it is revolving at approximately 1,000 r.p.m. a small quantity of molten sulphur is fed into it. When cool it forms a skin on the mold. This skin is coated with fine coke, the combination facilitating subsequent removal of the finished pipe.

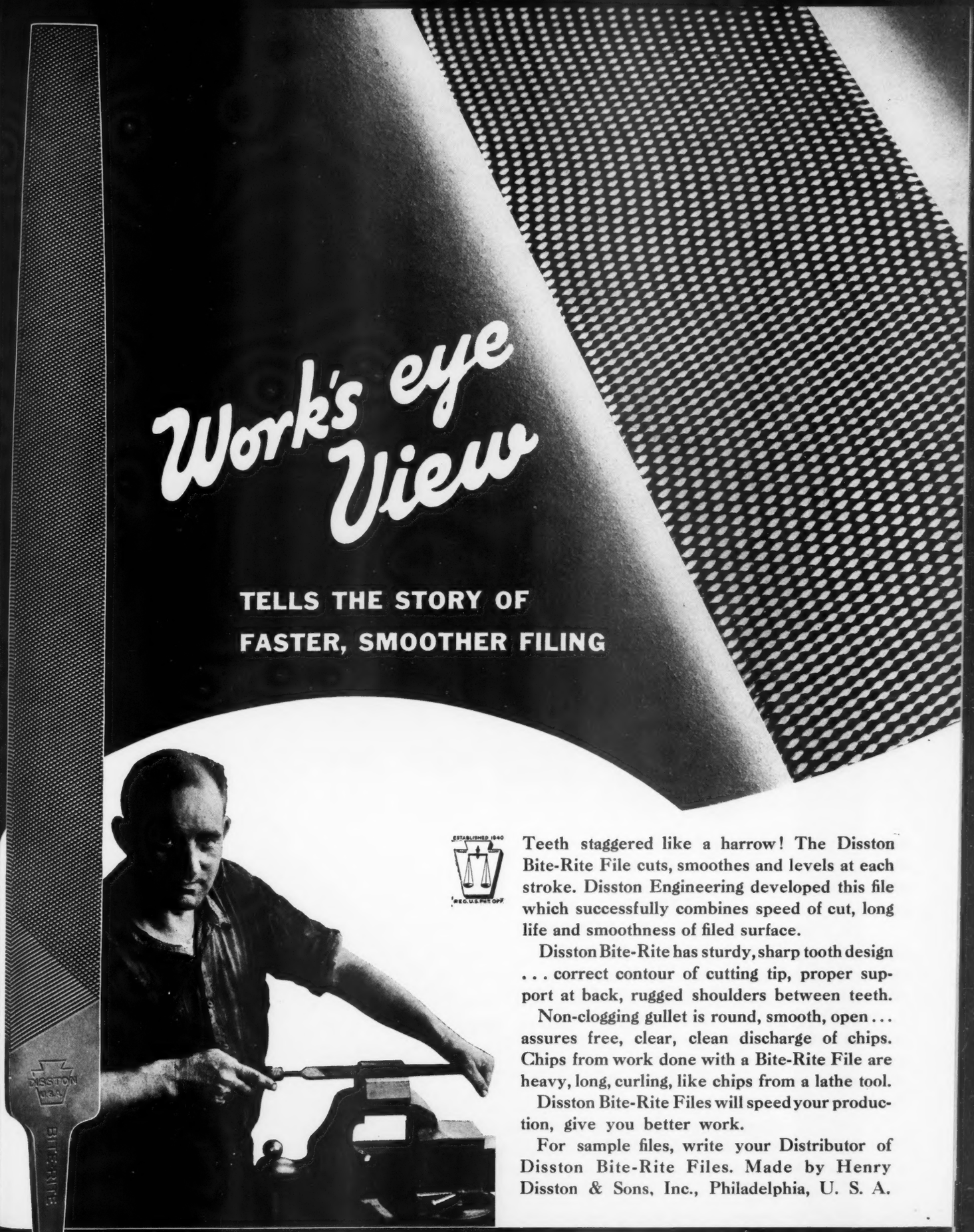
Formation of this skin of sulphur is followed immediately by the addition of coarse aggregated and a predetermined quantity of molten sulphur mixed with aggregate. The mold is rotated until the material is well compacted; then it is stopped and heated with steam to melt the thin sulphur lining, which allows easy withdrawal of the finished pipe.

Characteristics of sulphur pipes are given in the table.

The same principle may also be applied to the lining of steel pipe. The interior is first coated with a bituminous compound. Then a steam-heated core of the proper size is centered in the pipe and a mixture consisting of molten sulphur and aggregate is poured into the annular space. After the mixture has solidified the core is removed, leaving a pipe with a homogeneous interior coating of sulphur, which has been found to be very effective in protecting the metal from many corrosive liquids.

COMPOSITION AND CHARACTERISTICS OF SULPHUR PIPE

Weight per Lineal Foot, Pounds	*Composition by Weight, Per Cent*					*Strength, Hydraulic Pressure, Lb./Sq.In.*	*Tensile Strength, Lb./Sq.In.*
	Sulphur	*Sand*	*Coke*	*Gravel*	*Asbestos*		
34	83	..	..	..	17	95	152
35	66	16	7	..	11	85	136
35	57	23	11	..	9	65	104
38	35	..	..	60	5	75	120



Work's eye View

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Disston Bite-Rite Files will speed your production, give you better work.

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Phone Systems Within the Plant

(Continued from page 83)

these should be materially higher with a loud-speaking system than with a low-voice system. Of course, occasional replacement of vacuum tubes in the amplifier is necessary. This requirement, however, is offset to some extent by the elimination of cords, switchhooks, hand receivers, and other items which are occasional sources of trouble, and subject to wear and tear in conventional low-voice systems.

In the short space of time that has elapsed since the first of these new telephone systems was introduced, a considerable number of manufacturers of radio equipment have produced instruments of excellent quality that afford high-grade transmission and reception.

There is little doubt that in the near future further improvements will be made in the design of loud-speaking telephones. Sooner or later instruments will be produced that will not require the talk-and-listen switch, which is the only feature of these new instruments that requires a different method of operation than that to which the averge telephone user has become accustomed.

Lubrication on Incentive

(Continued from page 78)

to another, climbing up and down the ladder, and so on.

The data for each production department's equipment on each floor of every building are kept separate. It is accomplished by summarizing all figures in terms of standard time per machine as shown in Table D. This procedure is essential for cost purposes, as will be explained later, and also as a record of how the various machines were delegated to the proper shifts. Standard times are all totaled by shifts, with the exception of "shutdown work," which is made available in totals to be used later in scheduling the work to any shift. Standard minutes are converted to standard hours at this point in order to facilitate handling of schedules.

With data now available showing the amount of time necessary on each shift to lubricate the equipment, routes for each oiler were arranged as in Table E. These routes were arranged so that an oiler has a maximum of 6 hours' work (one shift) in any one day.

Laying out routes for the individual

WHY JIM SHOUTS AT HIS WIFE

Always a quiet sort, Jim got into the habit of shouting at people at his work, where every minute is a bedlam of deafening noises. There, everybody shouts.

Unconsciously, Jim carries over the habit of shouting into his home. His wife and children quake before his yelling.

How Many "Jims" in YOUR Plant?

In your plant — on time you pay for — how many "Jims" are exposed each day to irritating noise? Noise that saps their energy. Cuts down their efficiency. Devours *your* good dollars in costly overhead. You can eliminate an important part of this daily din! The answer is simple — and inexpensive. Just have those clanking steel wheels on inside trucks and trailers replaced with the new type Goodrich Vulc-On Rubber-Tired Wheels.

Your employees will be quick to notice — quick to appreciate — the immediate reduction of noise. And whether they know it or not, they'll be showing that appreciation. With so great a drain on their energy removed, they'll do *more work in less time.* Do *better* work, too.

Pocket these Savings

Not only will you reduce your plant's noise level by switching to quiet Goodrich wheels — you'll pocket many other important savings. Rubber saves floors — cuts repair bills. Plant operations are speeded up — materials handled faster. Less power is required to start and keep loads moving. There is less depreciation of equipment — less maintenance.

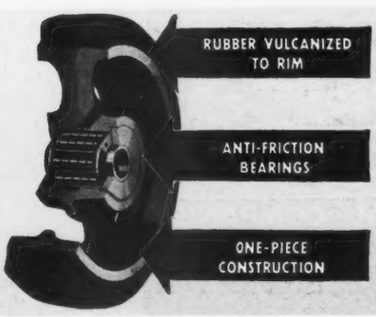
Goodrich Vulc-On Wheels have no nuts or bolts to loosen and get lost. They're made in one piece. They are rust- and corrosion-proof. Anti-friction roller bearings are used. And the rubber tires are *permanently* vulcanized to the metal rim.

ACT TODAY!

A Goodrich engineer is ready to analyze the material handling problems in your plant. He will show you how to reduce noise. He will figure costs — even *estimate the savings you can expect from a changeover.* Just phone the Goodrich Dealer or Goodrich Silvertown Store in your city. Or, if you prefer, send us the coupon below.

Goodrich *Industrial* Tires

THIS GOODRICH VULC-ON WHEEL *Pays its own way!*



Dept. N-57

The B. F. Goodrich Co.
Akron, Ohio

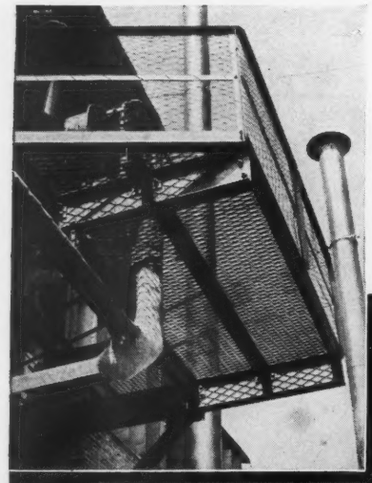
Gentlemen: Please mail me (without obligation) your booklet on Goodrich Industrial Tires and information on how they pay for themselves.

Name _____

Company _____

Street _____

City and State _____



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oilers on the various shifts entailed the necessity of seeing that the work was arranged in such a way that the minimum amount of time is spent in walking between buildings and riding on elevators. It could in most cases be done by having an oiler work on one floor level through the various buildings, which are adjoining.

As Little Walking as Possible

Consideration also had to be given to routing the oiler back to his lubricant supply station, so that he can replenish his supply of lubricants with the minimum amount of walking time. If it is difficult to solve this problem, in other plants, perhaps small substations could be placed in convenient locations along the route to help the oiler save time.

Having laid out the route for a maximum of 6 hours' work, the next step was to train the oiler to do the work in the way it was arranged. Written specifications (see Table F) showing what was expected of each oiler on each route were made available to the individual oiler and his foreman. Through the medium of this specification and the training the oiler received from his foreman very little trouble was experienced in getting the plan started. Only one route was started at a time, however, and the oiler was not put on his own resources until he had demonstrated that he could handle the work assigned and knew exactly what was expected.

No doubt one reason that only a small amount of trouble was encountered was because we assigned to each route the oiler who was most familiar with it. If green men had been selected the training problem would have been much more difficult.

Scheduling the Work

Routes for the entire plant having been assigned the next step was to schedule the work of the department. Since lubrication work follows directly the activity of the production department it was necessary, in order to schedule the work properly, to know what shifts and what hours the production departments were operating. This information is made available through a report known as the Weekly Closing Schedule. It is made out each week on Thursday and gives the closing and starting times for each department over the week end. On the basis of this information scheduling proceeds as follows:

1. On Monday of each week Table E is filled out, showing opposite each production department's standard hours the number of days it is ex-

Locklite

Simplifies AND *Safeguards* INDUSTRIAL LIGHTING

Only 2-Piece Unit that Signals when Reflector is Securely Locked in Hood

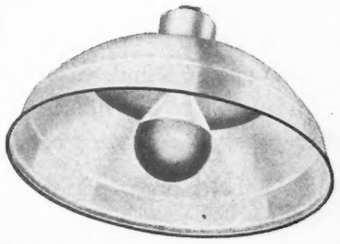
. . . Lights When It's Locked and Only When It's Locked

The new Westinghouse LOCKLITE, an exclusive electrical and mechanical connecting and disconnecting principle, simplifies lighting maintenance, offers greater safety, is easy to wire and install and provides high-efficiency industrial illumination.

LOCKLITE is available with RLM Standard Dome, Deep Bowl and Symmetrical Angle Reflectors; with the Shallow Dome Reflector and Glassteel Diffuser; and with the new RLM Silvered Bowl Diffuser . . . all manufactured by Westinghouse.

LOCKLITE units consist of the reflector, with lamp holder, and a LOCKLITE hood, with receptacle, for conduit or outlet box mounting. Positive contact between the lamp holder and the receptacle in the hood is assured when the reflector is locked in place. One hood fits all reflectors, both medium and mogul types, making all Locklite units interchangeable.

Ask your nearest Westinghouse Distributor for a **LOCKLITE demonstration right at your own desk,** or address Westinghouse Electric & Mfg., Co., Lighting Division, Edgewater Park, Cleveland, O.



SILVERED BOWL DIFFUSER

The NEW SILVERED BOWL DIFFUSER (available with Locklite construction) offers high-intensity, low-cost industrial incandescent lighting for close-seeing tasks. Designed for a 300-500-watt Silvered Bowl Lamp, this new reflector provides wide-spread, well-diffused, glareless illumination. Ask today to see this new unit in operation.

WHEN YOU THINK OF *Lighting Equipment* THINK OF

Westinghouse

We like to solve TOUGH ONES!

A new product on the board ready for production planning. A new finishing problem pops up! A score of ideas on how to do it. But none the answer! *That's* the time to call in a DeVilbiss Expert.

A DeVilbiss Expert likes to tackle *tough* spray-painting problems. And when he finds a job that requires special equipment, he refers it to DeVilbiss Engineers. Seldom have they failed to satisfy the buyer's needs—exactly.

DeVilbiss Experts are experienced in every phase of spray-painting—the production, cleaning, and regulation of air—the feeding of air and material to the spray gun—the ventilation of the painting area. These thoroughly trained men are at your command—any place, any time. Just write, wire, or 'phone. No obligation!

DeVilbiss Spray-Painting Systems offer users the widest range of equipment available *anywhere* for the economical finishing of a myriad of products. DeVilbiss service continues to follow every sale to insure the profitable operation of DeVilbiss equipment. The DeVilbiss Company, Toledo, Ohio.

The most advanced type of

Spray-Painting and Finishing Equipment, Exhaust Systems, Air Compressors, Hose and Hose Connections.

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pected that department will work during the week. Expected total hours for the week are then determined for each route and the schedule sheets are passed to the dispatcher-foreman.

2. On Thursday of each week, the Weekly Closing Schedule is received.

A Schedule Every Friday

If there are any changes in production operations, which usually occur at the end of the week, the total standard hours are revised to include these changes. An up-to-date schedule for each route is available on Friday morning to the dispatcher-foreman showing what standard hours are necessary. With this information he can, if required, rearrange his work immediately in order to insure 6 hours' work for all of the men on duty. Routes having less than 6 hours' work, due to certain production departments having ceased operation early for the week-end, can be given additional work by the dispatcher-foreman. In fact, there are a number of ways that work can be arranged to insure full 6-hr. routes. For example:

1. Shutdown work in those departments that have ceased operation can be done by an oiler who does not have a full 6-hr. schedule.

2. Two or more short routes that lie close together can be combined for one day in order to fill out a route of 6 hours.

3. Various cleaning work such as wiping lineshaft drip pans in a department not in operation can be combined with a short route to insure full 6 hours' work.

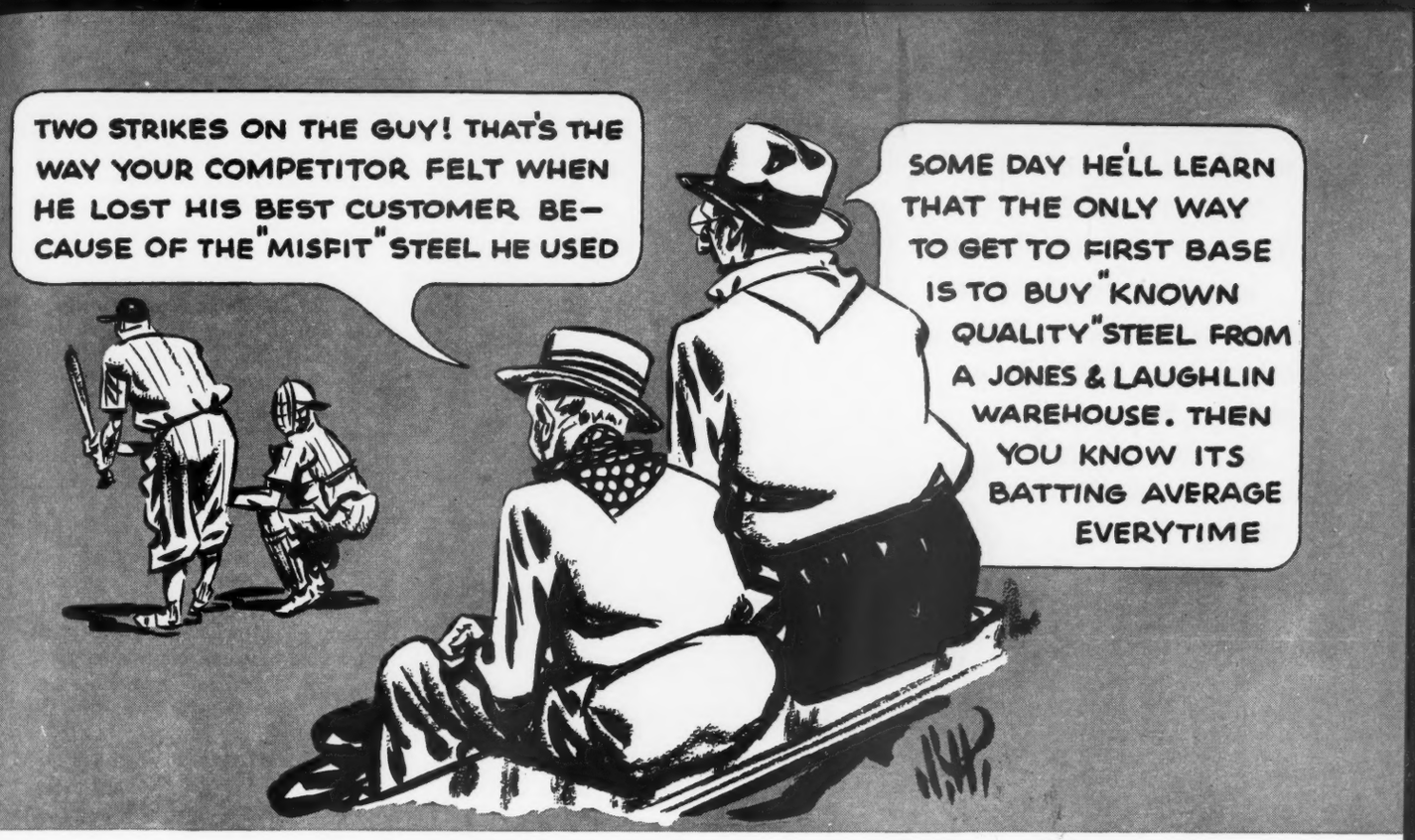
(A succeeding article, to be published in an early issue, will describe the incentive plan of payment that was set up. — Ed.)

Quick Deliveries, Because . . .

(Continued from page 51)

give good service. Under the system described, the average has been raised to over 60 per cent with a peak of 67 per cent of all *items* on all orders shipped complete. That is close to tops with 1,500 items in three or more finishes, unless inventories are kept uneconomically high.

Factory orders are placed by the production record clerk from the order slip (see Figure 3) O.K.'d by the superintendent. All work in the factory is done either on a "production order" to produce unfinished stock from raw materials, or on a


TWO STRIKES ON THE GUY! THAT'S THE WAY YOUR COMPETITOR FELT WHEN HE LOST HIS BEST CUSTOMER BE-CAUSE OF THE "MISFIT" STEEL HE USED
SOME DAY HE'LL LEARN THAT THE ONLY WAY TO GET TO FIRST BASE IS TO BUY "KNOWN QUALITY" STEEL FROM A JONES & LAUGHLIN WAREHOUSE. THEN YOU KNOW ITS BATTING AVERAGE EVERYTIME

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• When you buy J & L "known quality" steel you are sure of getting exactly the grade you order, for we know the complete history of every bar of steel in our stock. Careful records are kept of each heat produced, and in that way we can check chemical analysis and physical properties of any grade of steel you specify.

Each J & L Warehouse carries an extensive line of steel products in various sizes, shapes and grades, and has all the facilities for cutting, bending, forming, welding and fabricating steel. As a result of this extra service, you get the products you need in ready-for-use form—in the shortest possible time. Eliminate "blind buying". For complete and lasting satisfaction, use "known quality" steel from a J & L Warehouse.

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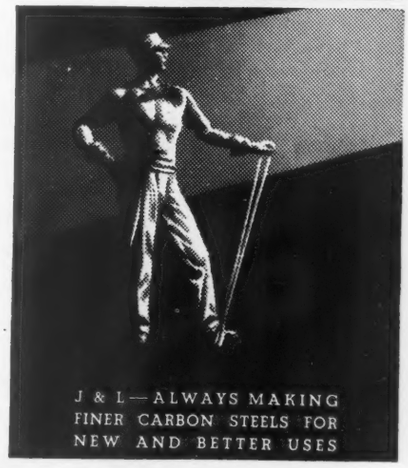

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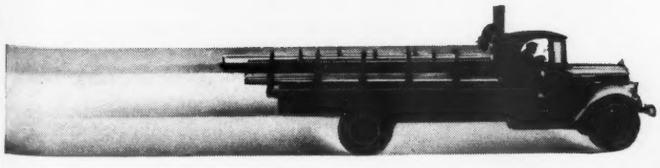

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FOR EVERY NEED THE RIGHT QUALITY OF STEEL IN A FULL RANGE OF SIZES

This photo shows what excellent seeing conditions are provided when light conditioning was installed in this American Tobacco Co. office.

HOW LIGHT CONDITIONING SPEEDS WORK IN AMERICAN TOBACCO CO. OFFICES

THE American Tobacco Company, makers of Lucky Strike cigarettes, recently light conditioned all five floors of office space in their 111 Fifth Avenue Building, New York City.

Although the former lighting installation provided 20 footcandles of illumination, the new lighting with G-E MAZDA lamps in totally indirect luminaires provides between 32 and 38 footcandles.

Both office employees and company officials say that the new lighting speeds work because they can see more easily and tire less rapidly.

Like many other leading companies, the American Tobacco Company uses G-E MAZDA lamps for light conditioning their offices. For these lamps are brighter than ever before and give more light at no additional cost for electricity.

For details on how light conditioning can increase efficiency in your plant or office, write to General Electric Co., Dept. 166-FM, Nela Park, Cleveland, Ohio.

USE A G-E LIGHT METER TO MEASURE YOUR LIGHTING

Every office manager and plant superintendent should have one of these G-E Light Meters that measure light simply, quickly. It shows instantly whether you are getting enough light for safe seeing in any office or industrial operation. It costs only $11.50 post-paid. Your lighting company will gladly measure the lighting in your plant or office with one of these Light Meters and show you how to improve seeing conditions.

GENERAL ELECTRIC

MAZDA LAMPS

They stay brighter longer

"finishing order" to finish unfinished stock from the unfinished stockroom or from originating department, or to refinish slow-moving finished stock.

The production order, Figure 4, is in four parts, one writing making the original, the originating department copy, and the material order in duplicate. The order describes the article, gives the quantity to be made and the material specification. The material order in duplicate goes to the raw materials room. It is the authority to send the material specified at once to the originating department, or as soon as the material arrives if it is not in stock. When the material order is filled, the pounds sent and the date are noted on both copies. One copy accompanies the material to the originating department to identify the order on which the material is to be used; the second copy goes to the desk of the production record clerk.

Finishing Order in Four Parts

The finishing order, Figure 5, is also in four parts, an original, two copies, and a master move card. One copy goes to the foreman of the assembly department, the order to foreman of the finishing department, as work must be scheduled closely through those departments. The master move card goes to the department sending the stock into the factory, i.e., to the originating department, the unfinished stockroom, or the finished stockroom. The master move card stays with the goods, leaving each department with the last portion of the order. Its arrival into a department, therefore, informs the foreman that all of the goods on that particular order have reached the department.

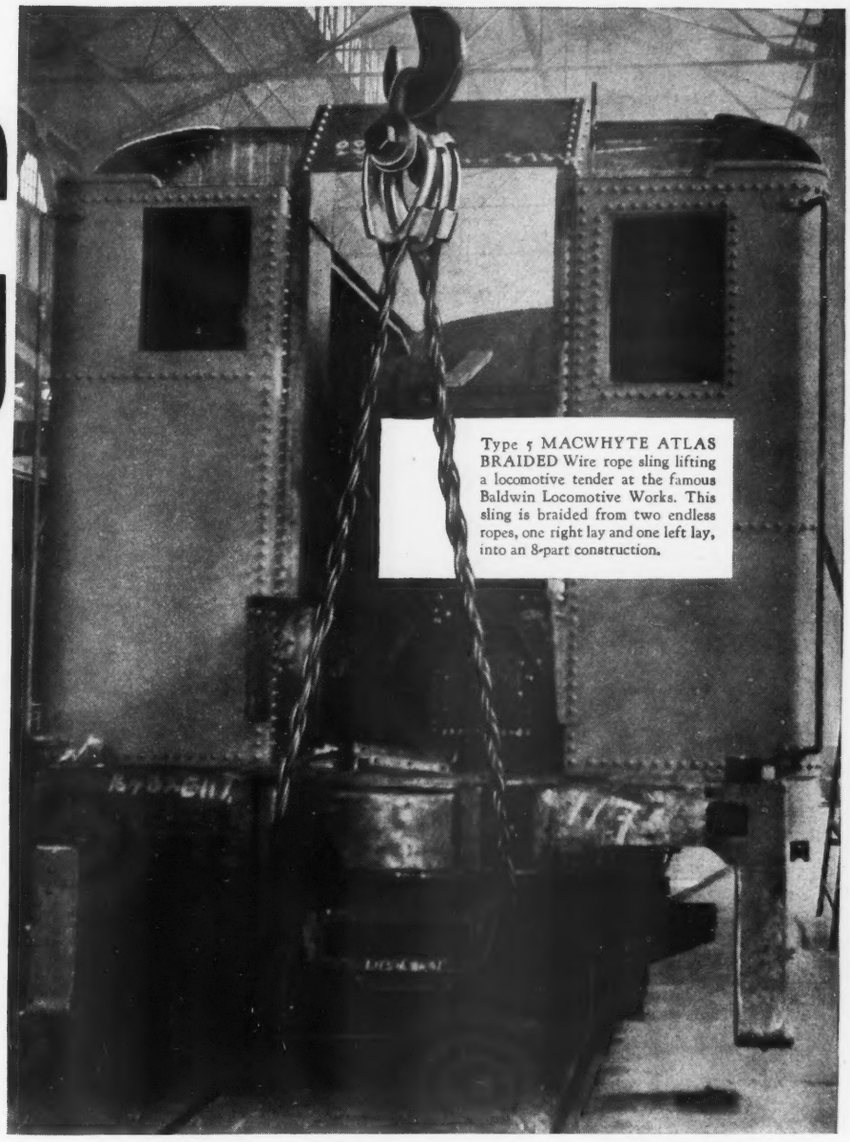
To expedite production and control in general there are four basic finish-order forms: "Nickel," with a blue master move card, "Brass," with a yellow card, "Raw," with a pink card, and "Special," with a white card. The finish is noted in detail as "Nickel—barrel plated, ball rolled," or "Special—white enamel, red inlay, nickel tongue."

Move tickets, Figure 6—their color the same as the master move cards—accompany work as it moves from department to department to identify the goods in the next department, and to furnish the basic production control data.

The move ticket has an original, a duplicate paper copy, and a triplicate cardboard copy. The duplicate and triplicate copies go with the work out of the department. The original is sent to the desk of the production record clerk. In the originating, assembly, and finishing departments, the

BIG OR LITTLE *or light* HEAVY

MACWHYTE
BRAIDED WIRE ROPE SLINGS
HANDLE ALL LOADS
WITH EQUAL EASE!



Type 5 MACWHYTE ATLAS BRAIDED Wire rope sling lifting a locomotive tender at the famous Baldwin Locomotive Works. This sling is braided from two endless ropes, one right lay and one left lay, into an 8-part construction.

Running smoothly over steel rails behind one of Baldwin's famous locomotives... that, before long, will be the job of this low-slung, heavy, compact tender.

Usually, tenders built like this would be hard to handle in production. But not when Macwhyte Slings are on the job!

Easy to Handle. Safe Beyond Comparison

Because of their special 8-part braided construction, Macwhyte braided wire rope slings are light-weight, flexible and easy to handle. They can be put around the load easily and quickly. They hug the load. Unusual strength...light weight...flexibility... resistance to kinking...these features make for SAFETY, and tend to speed up operations.

Today these slings are standard equipment in many of America's leading manufacturing plants. If you are interested in safer, speedier, and more economical materials handling, it will pay you to inquire about these remarkable Macwhyte Braided Wire Rope Slings.

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1 *Expert consulting service.* Write us about *your* handling problems. Our engineers will study them, help you solve them, show you how to get better service at lower cost. This consulting service is FREE.

2 *How to Handle Loads Safely*... an on-the-job booklet showing how Macwhyte Slings solve materials handling problems of every kind, every day. Send for this free booklet.

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MACWHYTE
Braided WIRE ROPE *Slings*

department clerk enters on the department copy of the production or finishing order, as the case may be, the date and quantity of the material moved out of the department.

Each movement of work from department to department is recorded by the production clerk from the move ticket to the proper finishing order or production order in the space provided for that purpose. Thus, at any particular moment, the location of an item in process can be known instantly.

Promised orders are pushed through the factory by the following routine. The production clerk knows what orders are to be promised from the promise stamp on the production copy of the retyped customer's order. The promised date of shipment is set after an analysis of the situation for each item. The time to ship considers the starting point—if to be made fresh from raw stock or finished from unfinished stock, or refinished from finished stock, or already in process in plant; the raw material stock conditions; the condition of the tools; and the available capacity in each department that will work on the item. The production clerk writes up a "Promise Ticket," Figure 7, as completely as possible when the promise date is decided upon and posts the item and date on the "promise sheet."

The "Promise Sheet" shows for each item the date of the customer's order, date order typed, the customer's name, and the promised date of shipment. As shipments are made, the items are crossed off the list. At the end of each week, the sheet is typed fresh to show all promised orders still unshipped and to rearrange items entered during the week according to promised date of shipment.

Discussion of the "promise sheet" with the works manager assures the production clerk that extra pressure will be applied when and where needed to give best customer satisfaction. Four copies of the promise sheet are made, one for the foreman of each of the following departments, assembly, finishing, packing, and shipping.

Deliveries Posted

Promise Tickets are completed by the production record clerk from data at his desk, and are kept posted as to deliveries. From the promise tickets, the production record clerk posts the new promised items to the copies of the promise sheet in the assembly, finishing, packing, and shipping department. Thus every foreman knows what is expected of him and knows where, when, and how he can help.

Unpromised customer orders and stock orders are kept moving by this check. At the end of each week, the production record clerk scans the uncompleted finishing orders and notes every order that has not moved through the next department during the week. Lists are made up for each department showing the orders not worked on, and given to the production clerk. The production clerk talks over the lists with the respective foremen and checks each day to see that all possible orders are worked on while getting out promised work. Thus no order is lost sight of.

Lists of Waiting Orders

Each day a list of production orders waiting for material and a list waiting for tools are sent to the works manager by the originating department. The lists are discussed with the production clerk to ascertain the urgency for each item, and the necessary action is taken.

Quantity produced is an important phase of production control. Department clerks reports total pounds moved out of the department, pounds sent to the packing room, pounds sent to the finished stockroom. The unfinished stockroom reports the pounds

Easy does it!

● Handling green cores in this foundry is a job reserved entirely for Baker Trucks. In general service their heavier loads and quicker trips show substantially lowered costs. But the big saving is in eliminating core loss. Their smoother lift and starting prevents shock and the resulting core breakage which formerly occurred with other equipment.

Savings like this are only one of the many ways Bakers are cutting costs in thousands of plants. They can save for you, too. Get all the facts from the Baker Material Handling Engineer. Have him estimate the savings possible in your plant. Write today.

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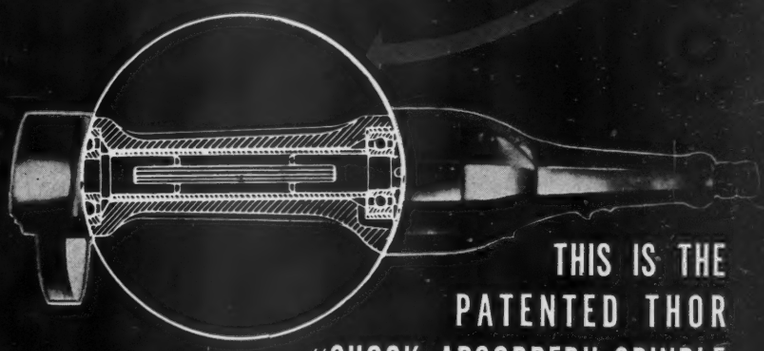
THIS SIMPLE DEVICE

SAVES HOURS, MUSCLES AND DOLLARS IN GRINDING



THIS IS THE PATENTED THOR "SHOCK-ABSORBER" SPINDLE

Note the two-piece spindle . . . joined with resilient steel strips. It absorbs and stops all vibration at the spindle . . . BEFORE it reaches the motor. The resilient steel strips . . . not the motor . . . take the terrific shocks when powerful Thor grinders go to work. This exclusive Thor method of Vibration Control prevents lead wires from breaking and causing motor burnouts . . . assures smooth, easy handling, uninterrupted service and low upkeep costs.

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GRINDERS

PERFECTED FOR PRODUCTION SERVICE

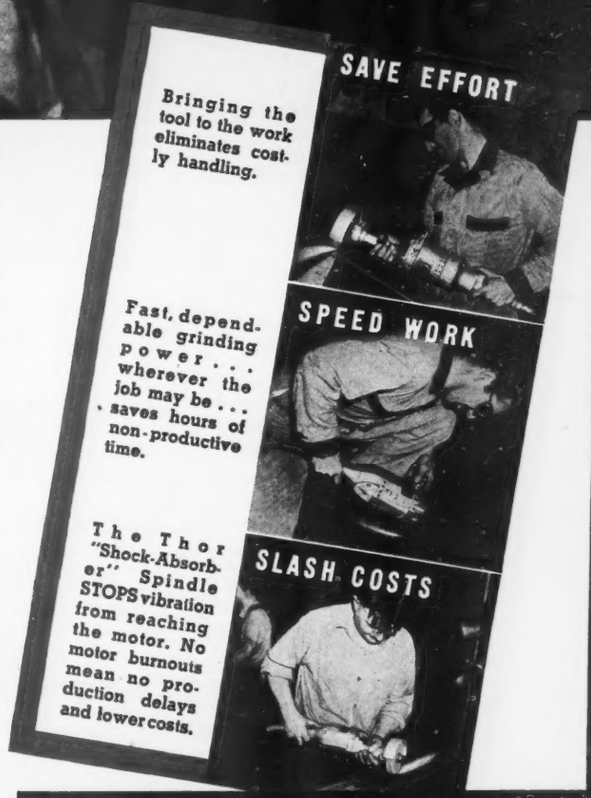
A simple change in the basic design of a spindle . . . substituting resilient steel strips for the old-fashioned solid piece, is revolutionizing the grinding practices of the leaders in the metal fabricating industries. Many have already standardized on Thor Portable Electric Grinders with the patented "Shock-Absorber" Spindle . . . and are saving hours, muscles and dollars in grinding.

HOURS . . . because Thor Grinders make it possible to take full advantage of the time saving benefits of bringing the tool to the work.

MUSCLES . . . because bringing the tool to the work eliminates costly handling that tires men and reduces efficiency.

DOLLARS . . . because the patented "Shock-Absorber" Spindle prevents vibration from reaching the motor . . . stops lead wires from breaking . . . minimizes motor burnouts.

Less hours . . . less work . . . less upkeep. Now it is practical to use portable grinders on production — and there's a place in your plant where a modern Thor grinder can save effort, speed work and slash costs. Get all the facts. Use the coupon below.


Bringing the tool to the work eliminates costly handling.
SAVE EFFORT
Fast, dependable grinding power . . . wherever the job may be . . . saves hours of non-productive time.
SPEED WORK
The Thor "Shock-Absorber" Spindle STOPS vibration from reaching the motor. No motor burnouts mean no production delays and lower costs.
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received into unfinished stock, and the shipping department the pounds shipped. Daily, weekly, and quarterly reports are made to show the increase or decrease of unfinished stock, of work in process, and of finished stock. The poundage out of each department indicates also the activity of the department and is the basis of quantity control for departments other than the originating departments.

Poundage reports, therefore, are the pulse of the factory to the works manager. They tell him where attention is needed.

Management's Aims and Responsibilities

(Continued from page 57)

were no less the product of a great faith—a belief in individual liberty which made this nation for generations a shining beacon to the oppressed of every land. Here was opportunity and a boundless future.

It is true, of course, that America has possessed advantages which could be found nowhere else in the world. Here there was a fortunate combination of nature's bounty, of climate, of soil, of limitless resources spread across a continent which knew no political boundaries; of a people recruited from the most venturesome of the old world stocks; of a unique form of government, which, by guaranteeing freedom and liberty, encouraged men to do the best that was in them. But behind all these material advantages, the real driving power that has made possible such a record of achievement has been the impelling force of invention, research, and creative management.

As we look forward to the second third of this twentieth century, what are the aims to which the new profession—management—addresses itself today? What are the goals that lie beyond the new horizons?

Management a Trusteeship

In the complex industrial society under which we now live, management no longer represents, as formerly, a *single interest;* increasingly it functions on the basis of a *trusteeship,* endeavoring to maintain a proper balance of equity between *four* basic interlocking groups:

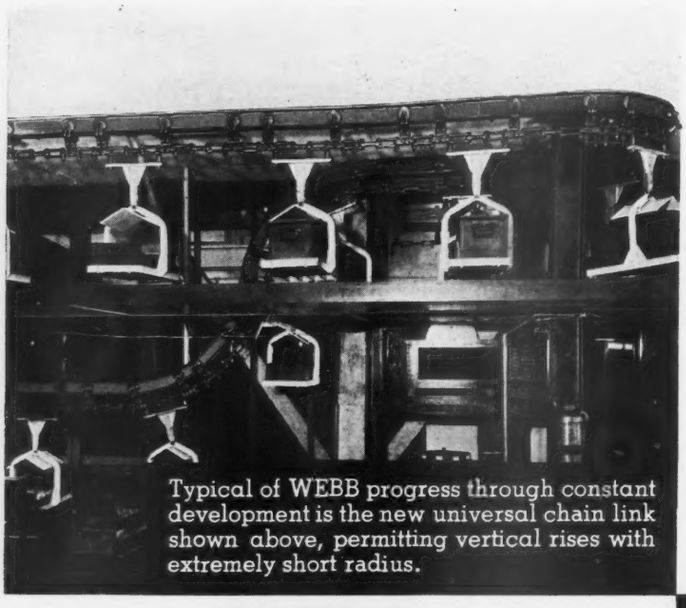
1. The shareholders—the millions of people in all walks of life who join together to provide the capital, and thus the tools indispensable to modern production.

2. The jobholders—those who, by brain or physical energy, make the tools productive.

3. The customers—those constituting the great army of purchasers who by comparing one product with another, by closely scanning prices and quality, energize the competitive system in its constant search for improvements that make for progress.

4. The public—those who are the indirect beneficiaries of this manufacture and interchange of goods and services. They, the public, through their government, are the ultimate umpires, insisting that all participants in the transactions of business receive a *fair deal.*

Let us now consider briefly some of the obligations that now attach to this trusteeship of Management. Machines, materials, and men—the three primary factors of free business enterprise—cannot be assembled without money. To obtain this voluntary capital, the first essential is investors' *confidence.* As part of this essential, it follows that the enterprise must be operated so efficiently that fair and adequate profits, in proportion to the risk assumed, are returned to the shareholder. Management also owes an honest and adequate accounting of its stewardship to the shareholders, to the jobholders, and to the pub-


Typical of WEBB progress through constant development is the new universal chain link shown above, permitting vertical rises with extremely short radius.

WEBB *means the* BEST!

To build the finest conveyors in the world has been the fixed determination and ideal of the Jervis B. Webb Company for more than 20 years. To buy such conveyors, is the equally fixed purpose of those who know that only through buying the best they can secure the most economical material handling system. Such concerns, including both the largest and smallest American corporations, have been standardizing on Webb Conveyors in ever increasing numbers throughout the years —proving that the ideal is now an established fact.

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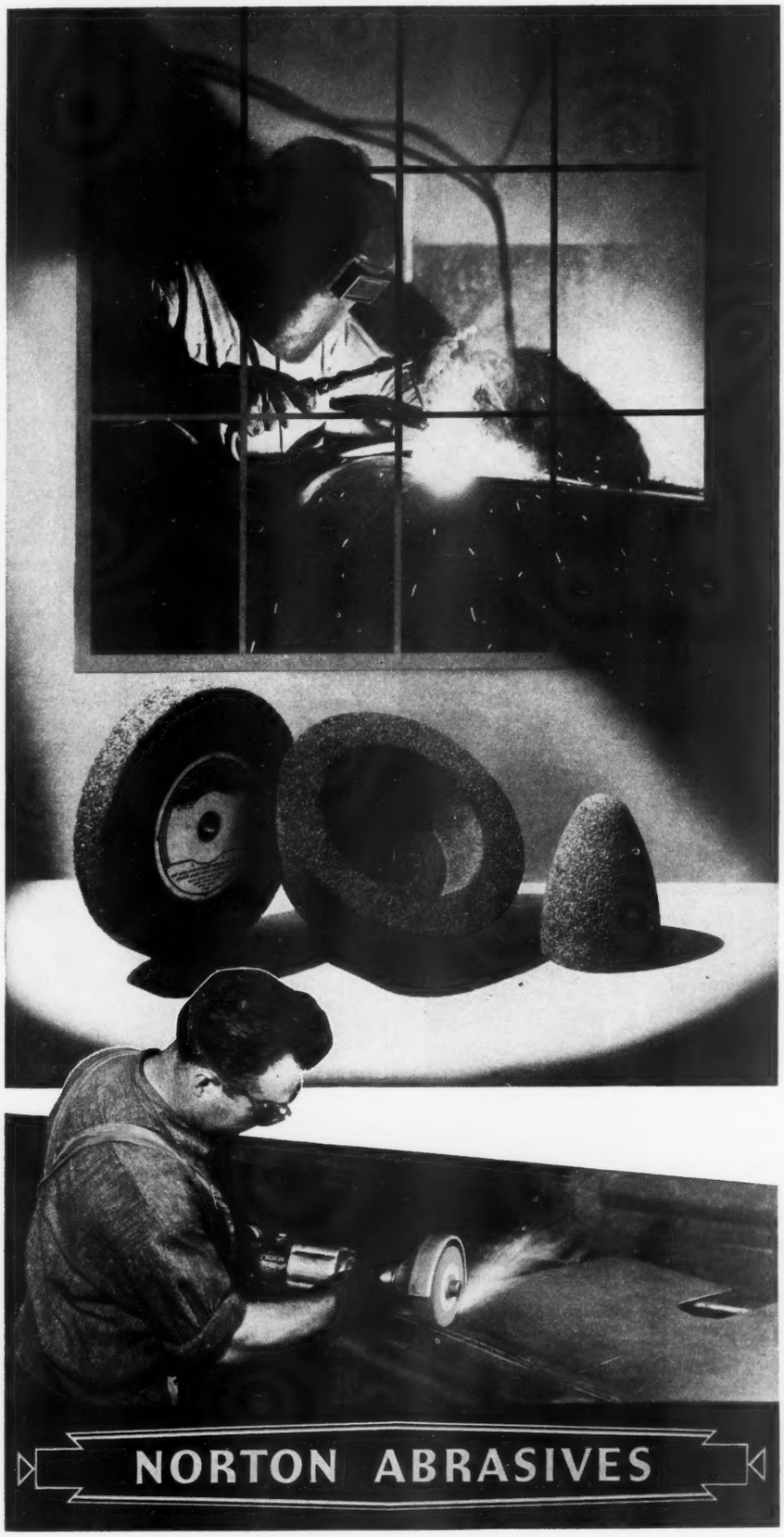
For Fast Cutting Plus Good Finish . . .



USE NORTON WHEELS for Weld Grinding

FAST cut and good finish are the two important requirements of wheels for grinding welds — fast cutting to quickly remove the excess metal; a smooth surface for the subsequent finishing operations.

There are Norton Wheels developed especially for the work — straight wheels, cup wheels, cone wheels — vitrified, rubber or resinoid bonded — hard, tough Alundum abrasive.

And if you are polishing after grinding, there is Alundum grain for set-up wheels; also Behr-Manning Metalite Discs for portable sanders.

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W-663

lic, while no less important is constant vigilance in preventing loss of the capital investment.

After the fundamental requirements of financial stability and credit have been met, management's second set of responsibilities runs to the members of its working organization. As trustee for the jobholder, management must see that the worker gets his fair share of the fruits of the tree of productive enterprise, consistent with the rights of the shareholder, the customers, and the public.

As the interdependence of different social groups comes to be better understood, so are their mutual obligations to each other more clearly perceived. The jobholder cannot produce without tools, materials, and money. The shareholder cannot profit without the time, the ideas, and the dynamic energy of men supervising uncarnate power now harnessed to the machine. None can *have* except as together all *produce*.

Through the development of industry, labor has won its emancipation. Earning power no longer depends upon mere muscular brawn, but increasingly reflects skill and intelligence. Wages are set not by hours of hand labor but by the productiveness of the machine. In this new cycle of production-consumption and consumption-production, the jobholder is also the source of purchasing power; in what he spends as well as what he receives, he contributes to that reciprocal action without which modern industry cannot function.

What the Customer Wants

When we turn to the customer, industry's problems are far simpler. Most of us know how articulate the customer is in emphasizing what he wants. He knows his own power. He seeks the highest quality product at the lowest possible price, delivered either on planned schedule or to meet his greatest convenience. Management's job is the difficult one of pricing products low enough to insure adequate production volume and yet high enough to pay both the jobholder fair wages for his labor and the stockholder fair wages for his capital.

As we consider the possibility of fulfilling these responsibilities that now rest on management, we encounter at the outset two strange paradoxes. The first has to do with the relations between business and labor.

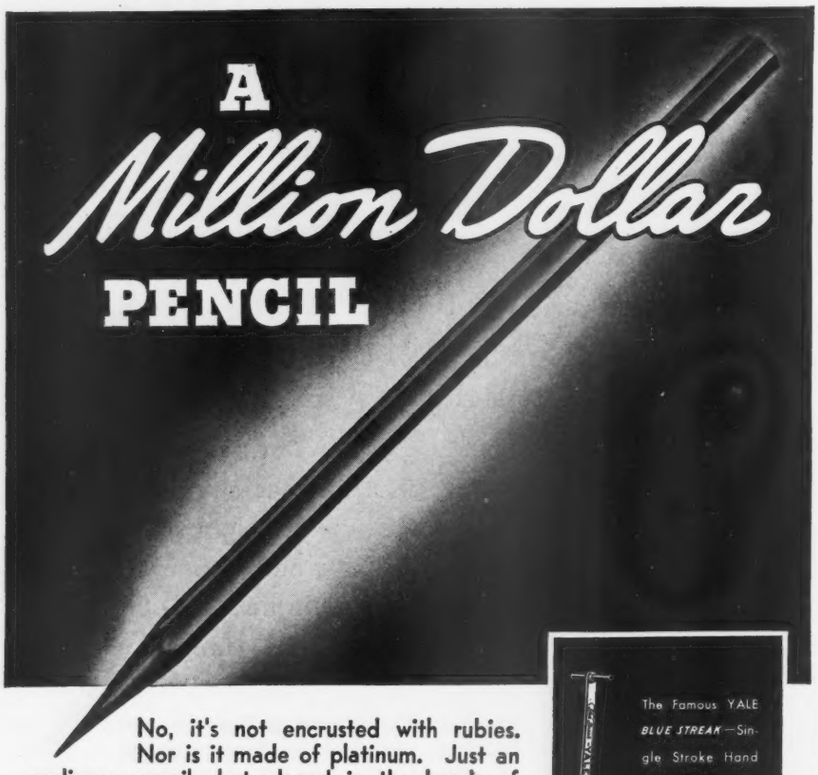
The newspapers are filled each day with accounts of strikes, disputes between employers and employees, of hearings before regional labor boards, of appeals to the courts against this or that decision. The impression the public gains is of constant controversy and strife. Management and labor, instead of pulling together in unison, appear to be headed in opposite directions.

A New Order Is Emerging

Yet these surface indications seem to me merely a new form of birthpains, which are completely deceptive as to what is really taking place. A new order of things is emerging; but as yet this new order has been obscured by dust clouds of words from political demagogues and radical agitators who have sought to extract personal advantages from the existing confusion. I venture the statement that, once the commotion subsides, those who have the interests of labor sincerely at heart and those who, no less sincerely, guide the destinies of industry, will be found nearer to fundamental agreement and accord than they have ever been before.

The right of jobholders to organize for purposes of legitimate collective bargaining is generally recognized, as is the desirability of intelligent and constructive leadership of labor organizations. The establishment of mu-

(Continued on page 130)



No, it's not encrusted with rubies. Nor is it made of platinum. Just an ordinary pencil—but placed in the hands of YALE engineers, it has saved industry millions of dollars yearly.

Always first, YALE engineers originate what others copy. From their fertile brains come the advances that make YALE Hand Lift Trucks the world's most efficient units of their type.

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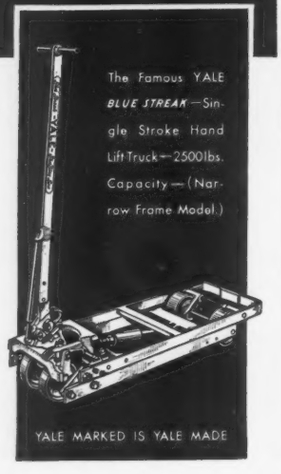

Ranging in capacity from 1,000 to 20,000 lbs.—one of these super trucks is just the answer for *your* handling problems. Put the million-dollar pencil to work for you. The nearest YALE representative will tell you how.

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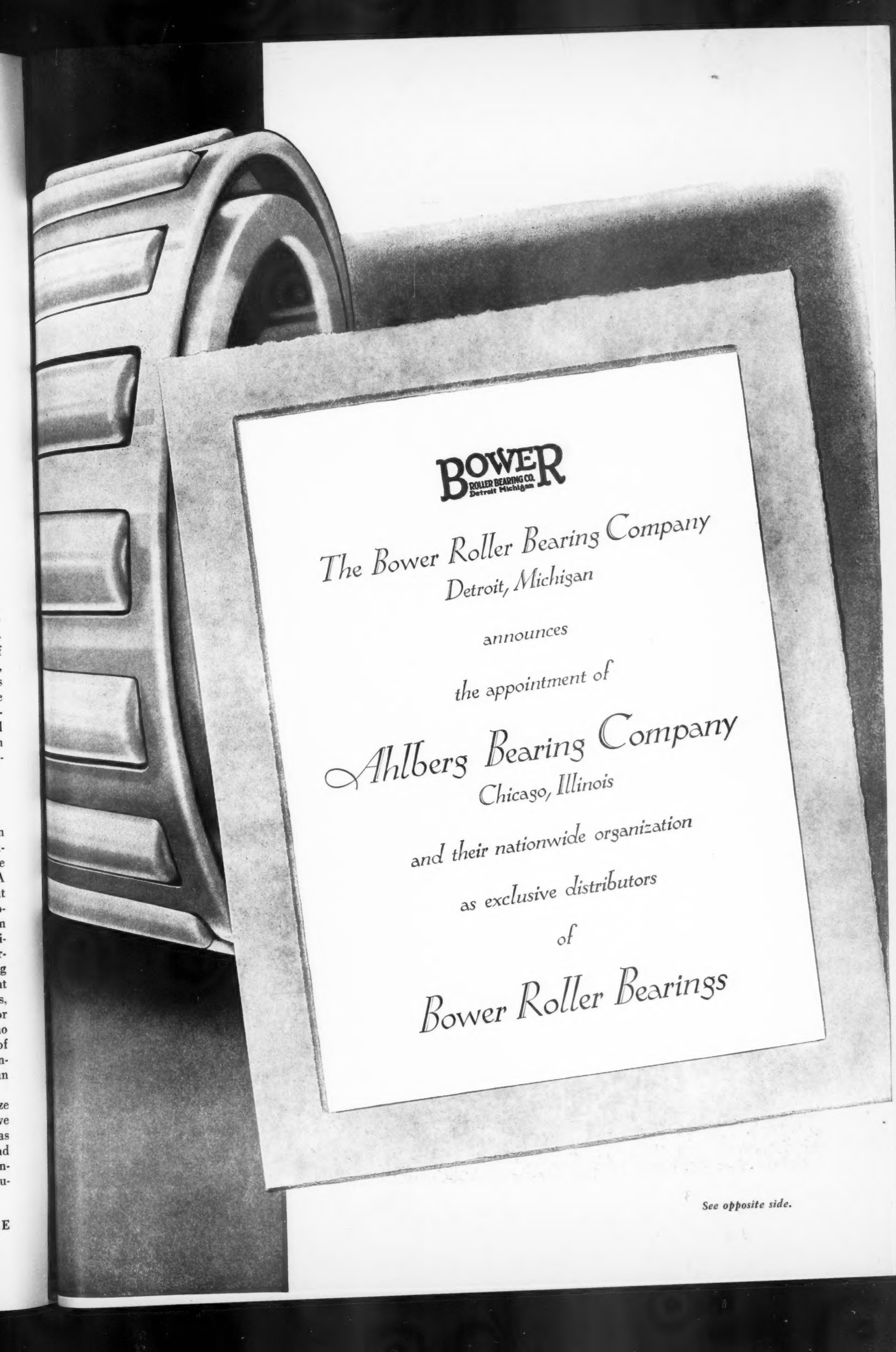

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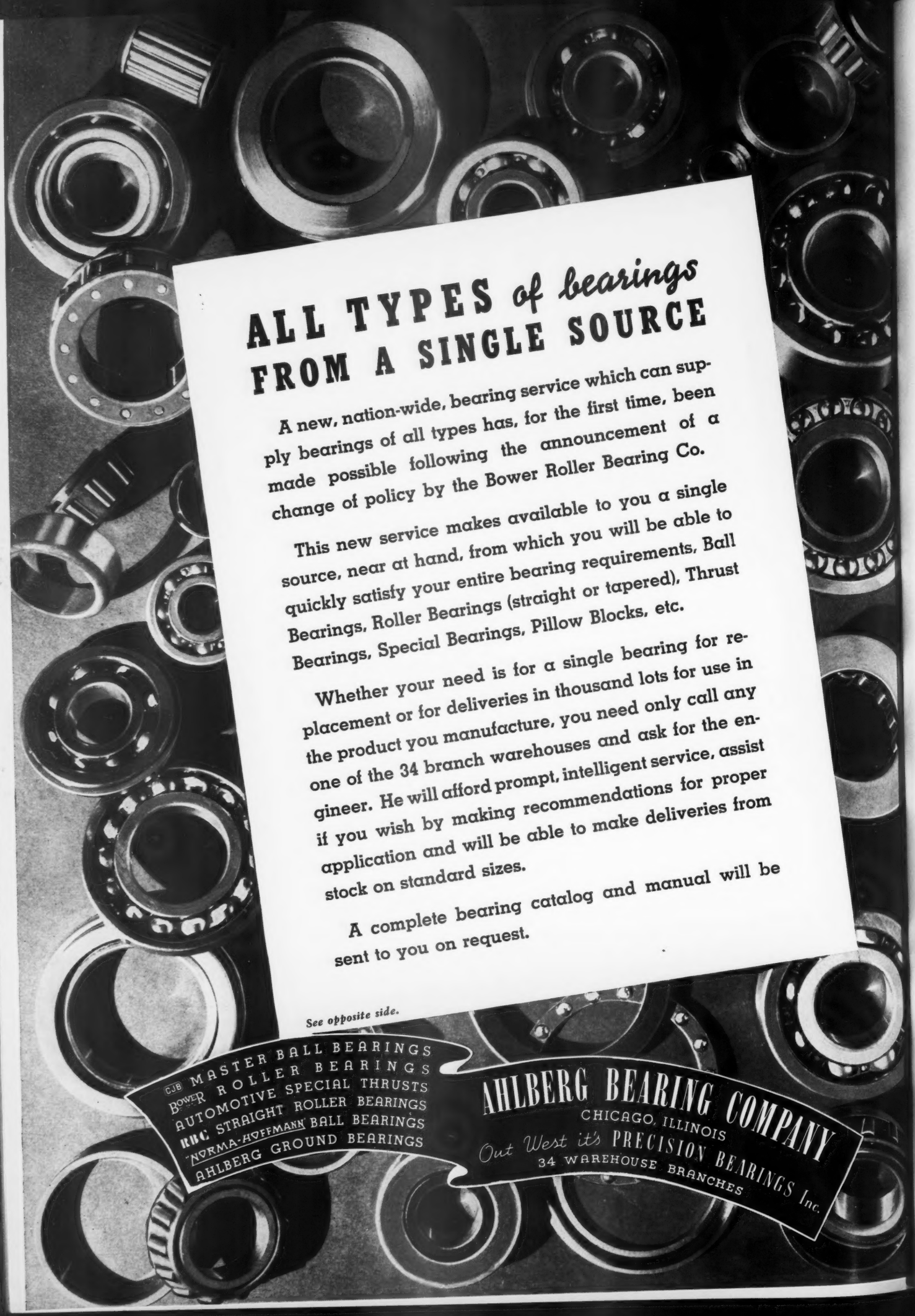

ALL TYPES *of bearings* FROM A SINGLE SOURCE

A new, nation-wide, bearing service which can supply bearings of all types has, for the first time, been made possible following the announcement of a change of policy by the Bower Roller Bearing Co.

This new service makes available to you a single source, near at hand, from which you will be able to quickly satisfy your entire bearing requirements, Ball Bearings, Roller Bearings (straight or tapered), Thrust Bearings, Special Bearings, Pillow Blocks, etc.

Whether your need is for a single bearing for replacement or for deliveries in thousand lots for use in the product you manufacture, you need only call any one of the 34 branch warehouses and ask for the engineer. He will afford prompt, intelligent service, assist if you wish by making recommendations for proper application and will be able to make deliveries from stock on standard sizes.

A complete bearing catalog and manual will be sent to you on request.

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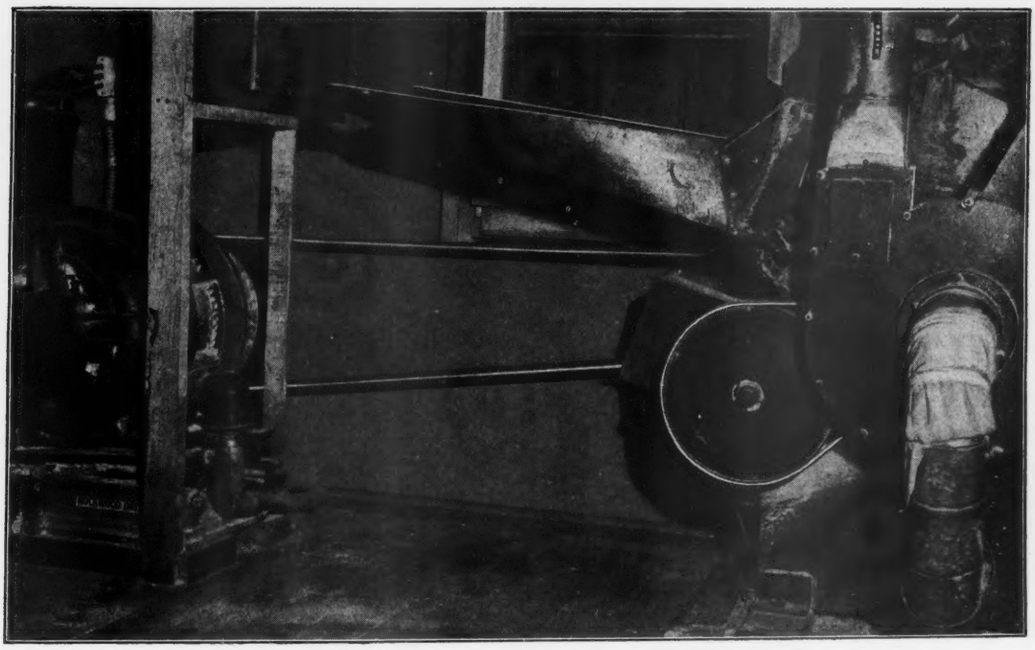
"NORMA-HOFFMANN" BALL BEARINGS
AHLBERG GROUND BEARINGS

AHLBERG BEARING COMPANY
CHICAGO, ILLINOIS
Out West it's PRECISION BEARINGS *Inc.*
34 WAREHOUSE BRANCHES



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THE *extra* qualities you get in Rhoads TANNATE Leather Belts help you, as they have hundreds of other plants, to cut maintenance, replacement and power costs —as well as to increase production. Their longer life, greater gripping power and flexibility, their freedom from stretch and greater strength are all the result of the famous, scientific Rhoads TANNATE Process . . . and the reason why they are the choice of more and more power transmission experts. And on short centers the TANNATE-Rockwood Drive proves even more efficient than V-Belts. These facts point the way to better performance and greater economy of operation—why not talk it over with the Rhoads TANNATE man the next time he calls? Or write us today for specific information—our Engineering Department is always glad to be of help.

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5 **ASSURANCE OF SATISFACTION** —through *Rhoads Service Guarantee.*

TANNATE LEATHER BELTING

LOWERS COSTS Per Unit of Production

(Continued from page 126)

tually satisfactory contractual relationships, religiously observed, makes for broader cooperation and builds toward industrial peace.

Responsible labor leadership upholds the principles on which rests the American system of free enterprise. It accepts the fact that labor can prosper only as industry prospers. It understands that high wages are dependent upon efficient tools and that those who provide the tools are entitled to a fair return for their hire.

Few differences of opinion are revealed when these underlying fundamentals are pondered and analyzed.

Neither a government inquiry nor elaborate statistics are needed to prove that American industry, by and large, has constantly striven to produce *more* for *less*, to lower the price, and improve the quality, through increases in volume and efficiency.

The philosophy of high wages and low prices through which increased purchasing power is spread among the workers, finds almost complete acceptance today. Scientific management condemns without reservation both child labor and sweatshop conditions; both are inefficient and clear evidence of poor management or antiquated social concepts. Similarly recognized is the necessity of healthful working conditions for employes, and the need for sick benefits and life insurance.

The principle of collective bargaining is now established by law. While many provisions of the National Labor Relations Act may justly be criticized as being discriminatory, and obstructing rather than furthering industrial peace, yet its essential purposes will endure. Crude and faulty as the statute is, it represents an attempt to substitute collaboration for conflict; its weaknesses will be corrected by amendment, as mutual confidence between labor and management replaces present suspicion and distrust.

This new concept of mutuality of interest, this goal of constructive collaboration, is foremost among the aims of enlightened industrial management. No one minimizes the difficulties that still lie ahead. Many clearly anti-social practices, such as sitdown strikes, lockouts, production sabotage, and gangster methods and labor racketeering must be eliminated. But if we work sincerely and honestly toward constructive industrial cooperation that cooperation will in the end be achieved.

Business and Government

Another equally strange paradox is encountered when one turns to the existing relationships between business and government. Both government and industry are inextricably bound together in a common task —that of ending the depression and rebuilding the nation's shattered economic life. Neither can solve this problem single-handedly. Yet, instead of collaboration and cooperation, particularly in lifting the heavy burden of unemployment, we find uncertainty and confusion, suspicion and recrimination.

Here, no less than in Europe, we are witnessing the reopening of that old argument which so perplexed the founders of our country. What are the functions of government; is it the servant or the master of men? What are the rights of the individual as against an all-powerful majority? What are "national" problems and what are "local" problems, and where is the line to be drawn between these two zones of administrative action? What is the proper field of public action and what can best be left to business initiative and enterprise?

There are many evidences that government will, in the future, exercise an increasing voice in the conduct of business. Once bureaucratic regulations are established, they are seldom, if ever, abandoned. What we must

HOW DO YOU BUY STEEL?

Purchasing management formerly placed orders for steel on a price and shipment basis on the assumption of standard quality. However, with automatic processes and higher speeds, greater strains, etc., much closer uniformity is not only desirable, but often absolutely essential in securing faster factory schedules and lower production costs.

Anticipating this situation, Ryerson turned all old stocks, tightened specifications, and made inspections more rigid.

Only whole heats of alloy steel in narrow range analyses are selected for stock. Bars from every heat are analyzed and actually heat treated. Data sheets showing exact analysis and heat treatment results are sent with every order as a guide to securing the best heat treatment results. In addition, Ryerson certifies to the uniform high quality of every steel product.

Never before has any such quality control been attempted by a steel service organization. But the results are well worth the effort. Manufacturers are reporting savings in time, reduction in spoilage and lower costs. The safety factor is also an important consideration.

Since this higher uniform quality can be purchased without increase in price, we believe it will pay you to concentrate with Ryerson. Remember the steel is in stock and shipment is immediate.

If you do not already have a copy, we will be pleased to send you our illustrated book completely describing the Ryerson Certified Steel Plan.

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Development of the SCIENCE OF HEATING LARGE AREAS

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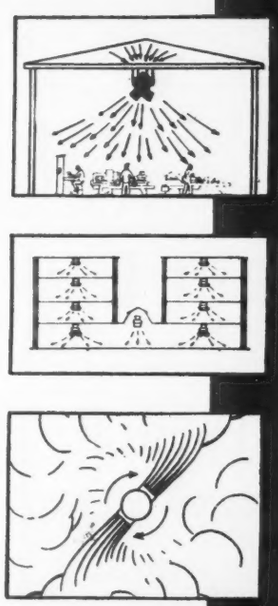
Wing *Featherweight* UNIT HEATERS *Floodlights of Heat*

Through constant improvement of methods of creating air turbulence and heat distribution.

1. Circulating air from the upper spaces, thus preventing accumulation of heat overhead.
2. Reheating and distributing it evenly and smoothly over the entire working area in a natural, healthy and comfortable manner.
3. Eliminating hot and cold spots and reducing heating costs.



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A Recognized and Highly Endorsed Pioneer Product.
Use the Original and Obtain all the Exclusive Features.
Our Field Engineers will gladly check your particular requirements.

L. J. WING MFG. CO.

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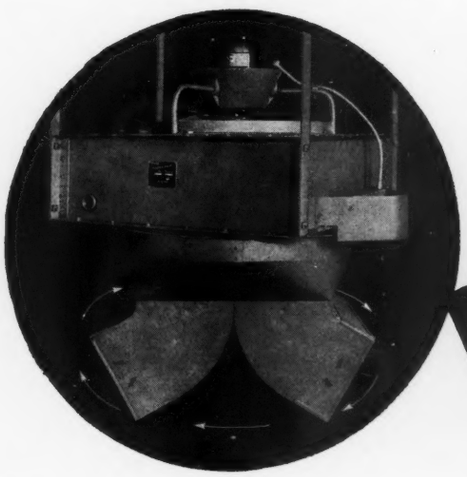

The latest addition is the Automatic Revolving Discharge, which produces the best results achieved to date in air turbulence and distribution, proven so necessary for even, comfortable heating.

One of the country's largest automotive plants.

strive for, therefore, is wise and intelligent supervision which aids rather than hampers business. That should be a realizable goal. Unless we are entering an era of political exploitation, whereby government is operated by and for the benefit of a vast party machine, rather than "for the people and by the people," then government itself should welcome the collaboration of technical experts, trained in business and understanding the problems of business, who can bring to these supervisory posts the vision and the skill that is required. Government needs to profit by industry's example and utilize, far more than it has in the past, this new profession of Scientific Management.

Adding to these misunderstandings between business and government, and therefore tremendously increasing the specific problems of business management, is our present confused state of mind as a nation. We are torn between contradictions. We seek to have more by producing less; we try to make money buy more by decreasing its value. We strive to create employment and at the same time pursue relief policies that encourage idleness. We hold thrift a virtue and then set an example of profligate spending. The right hand of government asks business to do something, and the left hand berates business for doing it. Taxes take an ever-increasing proportion of business profits; yet at the same time industry is being urged to put more men back to work. Federal monetary policy shifts from inflation to deflation and then back to inflation again. In short, we are attempting, as H. G. Wells aptly describes our great American experiment, "to raise the temperature by boiling the thermometer."

The problem of readjustment is two-fold: First, reorientation of businessmen to the great economic and social forces which now surround and control their own activities; second, an appreciation, by government officials particularly, that something more than hammers and monkey-wrenches is needed to repair the intricate and delicately balanced mechanism of the nation's economic life.

How industry must reorient itself is a problem that must be answered by management. We must add to those principles laid down by Harrington Emerson 25 years ago, a qualification which even he could not foresee.

Social Relationships Overlooked

So great is the interdependence of modern industrial society that, however efficient any single corporation may be *within* itself, it yet may fail in the proper discharge of its functions because of factors or conditions *wholly outside* itself. These outside relationships are today all important, and are thus aptly described by Dean Donham:

"As business men we have isolated ourselves. We have neglected sentiments and emotions. We have disregarded social groupings, social routines, and the little ways that tie men together. We have magnified the importance of economic institutions and forgotten the dependence of these institutions on social stability."

Is it too much to hope that, as we undertake a fresh attack on the nation's deepest and longest depression, we profit from the lessons of the past, from our record of achievement, by applying the principles which lifted America to primacy among the nations?

Let no one delude himself that modern management is smug about its achievements. Let no one assume that we seek to preserve the *status quo*. ignore mistakes and shortcomings of the past, or proclaim perfection, or blind ourselves to rapidly changing social and economic conditions. The social responsibility of industry is no empty phrase—it is an obligation to which modern management is deter-

SO THAT INDUSTRY MAY CAPITALIZE on the INDIRECT LIGHTING CHARACTERISTICS of this SILVERED BOWL LAMP

THE NEW BENJAMIN R L M
"SILVERED BOWL" DIFFUSER

Management is now offered the opportunity of providing at low cost a greater degree of EYE COMFORT for its employees through the installation of this new type of Benjamin lighting reflector. The new unit was specifically designed to utilize the indirect lighting characteristics of the silvered bowl lamp, and thus provide a softer, better diffused illumination with less sacrifice to high lighting efficiency.

The Benjamin "Silvered Bowl" Diffuser is a combination porcelain enamel and Alzak aluminum unit and represents a distinct advance in Industrial Light Conditioning. Because of the importance of the good lighting upon the Seeing Efficiency of the employee, and the ultimate production cost and quality of the product, this new unit warrants immediate investigation by every industrial management. Address your inquiries to your electrical contractor, wholesaler or to the Benjamin Electric Mfg. Co., Des Plaines, Ill.

BENJAMIN
LIGHTING EQUIPMENT
Distributed Exclusively Through Electrical Wholesalers

A THIRTIETH BIRTHDAY

IN OCTOBER of 1908 a slim, meaty little handbook came upon an unsuspecting world. It was the work of two young editors of AMERICAN MACHINIST. It was born out of their white-hot zeal to offer to the metal-working industries a handbook packed with dependable reference data applying to all branches of machine shop and drafting room practice—a handbook that would save effort and time, that would be of aid in the struggle for complete accuracy, for better standardization, for higher efficiency.

That little handbook became accepted and recognized everywhere as the standard manual of machine shop data and methods. It became the one respected reference book of the biggest machine shops in the country. It became the textbook placed in the hands of apprentices. In England it achieved a notable distribution. In far-off Japan it was widely used. It was considered so important by our own government that a special compartment to contain it was built into the gun carriages that went to the front in the World War.

Today that handbook is in its sixth edition—having reached a total issue of 287,000 copies. It has become the world's most widely used technical handbook.

On this the thirtieth anniversary of the publication of the AMERICAN MACHINISTS' HANDBOOK, we pay tribute to a great book —we pay tribute to a genuine contribution to American technical literature. And we salute and pay tribute to its widely-known authors, Fred H. Colvin and Frank A. Stanley.

MARTIN M. FOSS
President

McGRAW-HILL BOOK COMPANY, Inc.
330 WEST 42nd STREET NEW YORK, N. Y.

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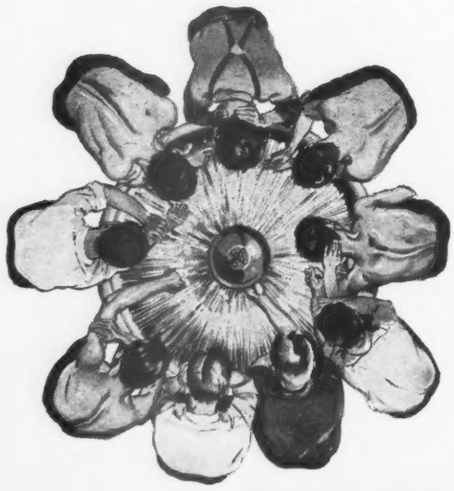
Pay for Your Modern Group Washing Fixtures

● Ten people can wash at a Bradley Washfountain at the same time—each has his own clean running water—yet for all 10, the water consumed is but little more than for one person at the conventional wash basin. Savings run as high as 80% . . . You can count on the *savings* to pay for these modern fixtures. Bradley Group Washfountains reduce piping and maintenance costs, too—and they will last as long as your building.

Our new Catalog 937 with layout suggestions will help you. Let us know your washroom requirements . . . BRADLEY WASHFOUNTAIN CO., 2215 W. Michigan St., Milwaukee, Wis.



Clean running water for all—at a Bradley

New Stainless Steel Model Washfountain

BRADLEY WASHFOUNTAINS

mined to bring far more than mere lip service. It ushers in a third dimension in the scheme of free enterprise. It calls for skill and creative accomplishment of a sort even more imaginative than did the past eras when management was struggling to create a new system of large-scale financing, of mass production, of nationwide distribution and merchandising in order to make possible the highest standard of living the world has ever known.

If it were possible, I should like to see the men of America who are managing business today, say to the American people that they adopt as an expression of their intent, their creed if you will, some such simple and understandable statement as follows:

[*The Creed of Management*, which appeared at this point in Mr. Brown's paper, is displayed on page 57.—Ed.]

That is my suggestion of a common meeting ground not only for management and labor, but for all of us.

We know that, if we were faced tomorrow with the prospect of another war in which we were compelled to take part, a national unity of action would be quickly achieved. Yet the emergencies of PEACE can be no less vital than those of WAR.

What we need, more than anything else today, is to affirm those principles upon which Government and Business, Labor and Agriculture can work together in the solution of a common problem. Once we are agreed upon our true objectives as a nation, unity of action will bring lasting business recovery. Without business recovery, based upon sound national policies, there can be no stability, no security—nor can liberty itself be long preserved.

Social and Economic Aspects of Management

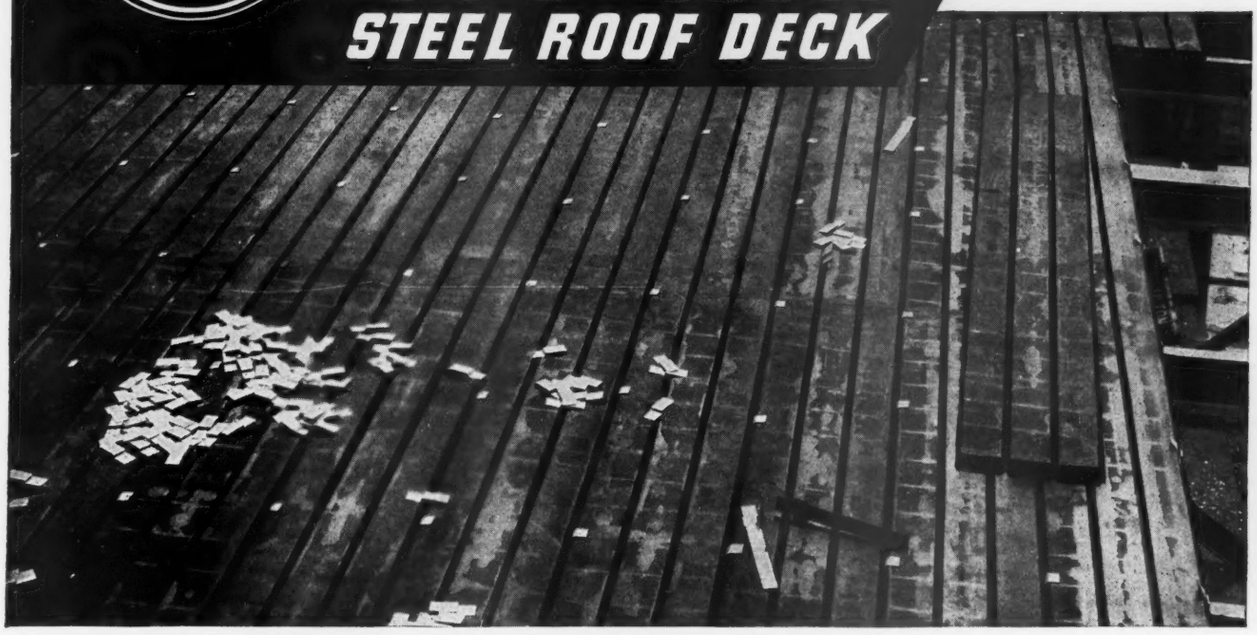
(*Continued from page 60*)

the consumer. The initiative in the modification of an article under production or in taking up the production of a new article or of a new line of articles in most cases comes from the distribution side as a result of pure research. In both cases intimate collaboration between production and distribution is essential for continued development. . .

Coordination of human efforts can never be successful without taking into account the psychological aspect. The individuals who are expected to collaborate must have a driving force to do so. Authority and discipline, loyalty, and common sense are good driving forces, but in my opinion there exists no better driving force than the personal economic advantage. A manager, if he were able to elaborate plans which make it possible

Wheeling
CORRUGATING COMPANY

Tri-Rib
STEEL ROOF DECK

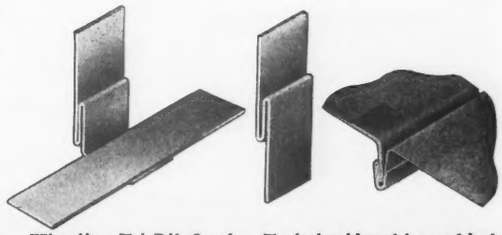


—The *NEW WAY TO ROOF INDUSTRIAL BUILDINGS* AT LOWEST COST

● In modern factory construction, the Wheeling Tri-Rib Steel Roof Deck provides a rigid, firesafe and economical roofing foundation that can be applied in record time. There are few units to handle; each consisting of a sheet of COP-R-LOY 18" wide, reinforced with three ribs spaced 6" on centers. These plates are 18, 20 or 22 gauge. They are joined together and attached to the purlins or other supports by clips or welding. Workmen can do the erecting from the top of the roof deck. There is no cutting or fitting on the job. The ends of adjoining plates overlap to form a rigid platform with a smooth surface throughout.

COP-R-LOY, Wheeling's tough, rust-resisting copper alloy, gives this steel deck extra long life. It is painted or galvanized. Write for complete details.

1. *Easily Handled*
2. *Quickly Applied*
3. *Firesafe*



Wheeling Tri-Rib Steel Roof Deck is fastened by specially designed clips. Above is the purlin clip to attach the deck to beam, channel or joist purlin.

To tie the sides of the roof deck plates together, intermediate clips like that shown above are furnished. The illustration at the right shows the intermediate clip in use.

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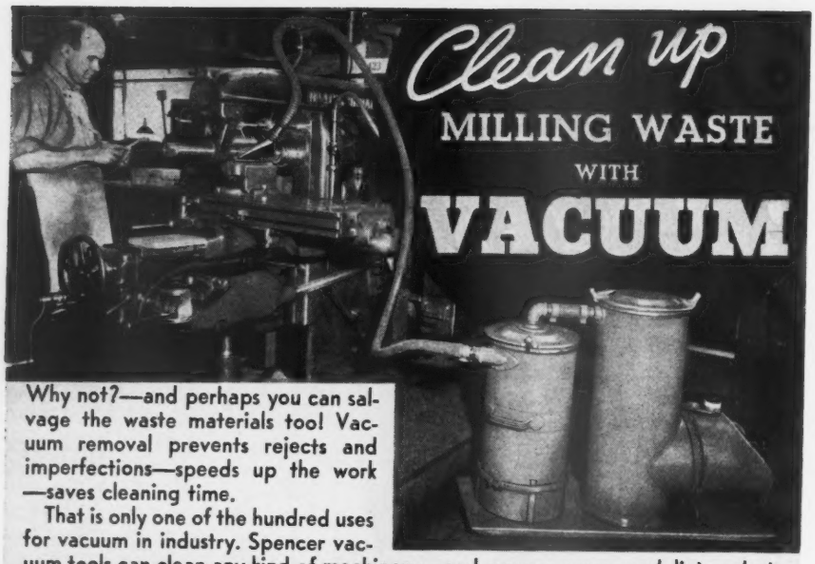
WHEELING CORRUGATING CO.
WHEELING, WEST VIRGINIA

KANSAS CITY · ATLANTA · COLUMBUS, O. · MINNEAPOLIS · RICHMOND · DETROIT



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Why not?—and perhaps you can salvage the waste materials too! Vacuum removal prevents rejects and imperfections—speeds up the work—saves cleaning time.

That is only one of the hundred uses for vacuum in industry. Spencer vacuum tools can clean any kind of machinery—and remove soap, sand, lint or dust.

Used at first to reduce dust hazards, they are now a recognized production tool—just like compressed air or steam. In fact, many companies have installed Spencer *Vacuum Lines* all over their plants.

Clean the machines, the walls, the floors, the shipping room with a trial installation of a Spencer Portable Vacuum Cleaner and see what a difference it makes.

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to pay every man in accordance with his value to the enterprise, would automatically come a good bit on the way toward a perfect coordination of all efforts. This manager does not exist and never will exist, but he is a good ideal. It is not enough to say that a good man sooner or later gets his chance, because the average man does not see this remote chance, while an immediate remuneration is very concrete and stimulating to him.

The Balancing of Incentive and Security

RALPH E. FLANDERS

President, Jones & Lamson Company
Springfield, Vt.

PROBABLY most of us concerned with management have come to the conclusion that there are two broad categories of employees. One is the routine worker whose principal desire is steady work at good pay. The other type, much smaller in numbers, is spurred by initiative and desirous of assuming responsibility and of expanding his responsibility to the limit of his powers.

These two classes considered in their broad human aspects do not constitute an inferior and a superior class. Both are necessary to industry. If all of us were in one or the other, industry could not survive. Especially should it be remembered that the larger group which looks primarily for security in industry is not the inferior class of the two. In mental equipment, in moral sensibilities, in capacity for the highest satisfactions of life, there will be found at least as many superior individuals among those looking for security as among those spurred by incentive.

Industrial management is after all a highly specialized form of human activity. Those who are fitted for it are not thereby picked out as being superior human beings. They are simply better adapted to a specialized range of human activities. Let us not make the mistake of concluding that excellence in our particular field means corresponding excellence in the general scale of human character. . .

What we have to learn is that there is no long-time security without incentive and initiative. For a continuance of achievement in our western civilization we must strike a balance between the two policies. We are like an army with new territory ahead of us. If it is unwise to extend the front line too rapidly lest our communications be cut off from the rear and our army destroyed, it is equally unwise to go into a permanently fortified encampment in our present location. This is not a good place to stop.

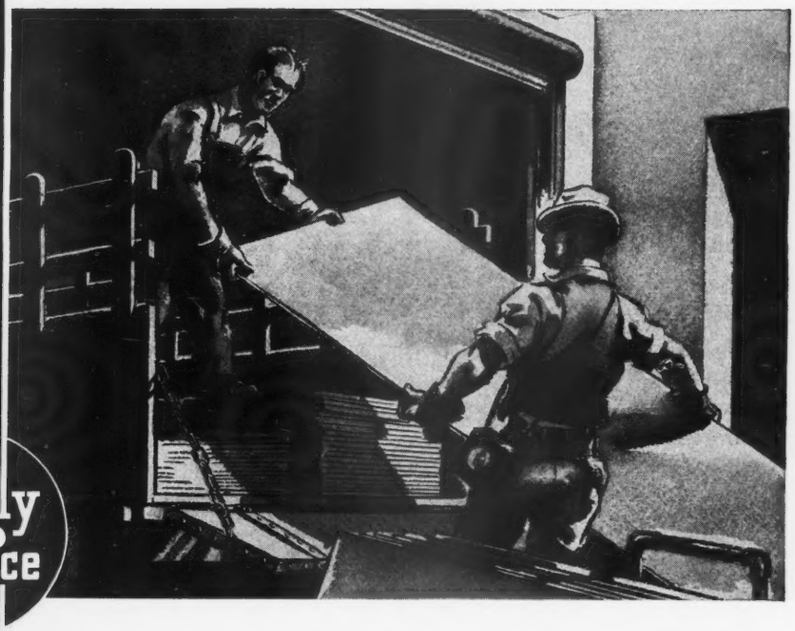
In view of the physical, technical, and human possibilities ahead of us, it is a primary duty of government to bring about within the governmental field the conditions which foster a revival of initiative and enterprise. Our present need is not alone for security but for incentive. On our return to incentive hinges the

PLENTY OF TIME OR NO TIME AT ALL . . .

SCULLY COMES THROUGH

LAST MINUTE CALL GETS SCULLY SERVICE

Saturday morning—11:30—phone order received for large tonnage of structurals. Needed at once! So our men stayed on the job—cut, loaded and shipped the structurals that same Saturday afternoon. The customer—425 miles away—had them Monday morning.



SHORT JUST A TON . . . SCULLY FILLS THE GAP IN A HURRY!

A manufacturer of auto accessories, working on an emergency order found himself short one ton of Cold Rolled Steel on Easter Sunday afternoon. But he knew Scully Service. At his call, our representative rushed to the warehouse, and with the watchman's help loaded and shipped the bars—and the manufacturer completed his emergency order that same evening.

YOU want quick service when you're in a hurry for steel—and prompt service on your every-day requirements, too. We operate on this principle at Scully.

Every one of our eight warehouses is ready to serve you from huge stocks of steel, steel products, copper and brass.

Phone, write or wire the Scully warehouse nearest you. And send for our handy, complete stock list and reference book.

SCULLY STEEL PRODUCTS COMPANY

Distributors of Steel, Steel Products, Copper and Brass

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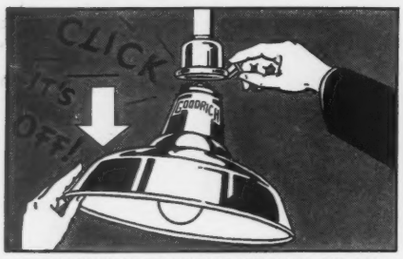
UNITED STATES STEEL

REMOVE THAT DIRT–
and Have Better Light!

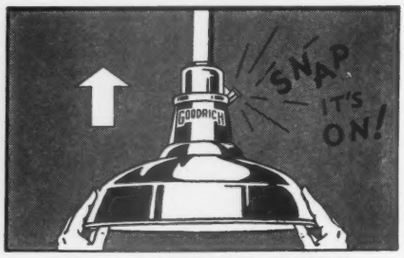
You can't expect workmen to do their best without good illumination. That's why it pays to keep your reflectors clean—to wash off the film of dirt and grease that collects on reflecting surfaces.

Use the reflector that's designed for quick removal—that's easy to keep clean! Makes it easier for you to maintain a higher standard of lighting efficiency—for skilled hands to work faster, with greater accuracy.

DISKONECT REFLECTORS



LIFT THE PLUNGER TO RELEASE REFLECTOR AND LAMP



WHEN IT SNAPS INTO PLACE, IT'S LOCKED

You needn't twist, tug or force. Reflector and lamp are released the instant you lift the plunger. To attach after cleaning, press into the hood and the spring-set plunger snaps into place, locks it securely. Complete "come-apart" permits cleansing of all parts separately—saves time—encourages frequent cleaning and better illumination.

See your electrical supplier or write us for folder on Diskonect Reflectors.

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success of our whole effort to attain a possible and desirable advance in the security of the whole mass of our fellow-citizens.

Psychological Foundations of Management

HENRY C. LINK
Secretary, The Psychological Corporation, New York

THE GREAT superstition of our mechanical civilization has been and still is the belief that human nature is beyond scientific analysis. Medicine, biology, and chemistry may analyze the body as a machine, but we have not yet conceded the powers of scientific psychology to study man as a human being. . .

More money is spent annually on redesigning and retooling the new automobile models than has been spent in half a century of scientific psychological research. . .

What are the results? One of the most popular is this: While denying the possibilities of a science of man, almost every manager regards himself as an authority on human nature. People who consider themselves ignorant of the dynamics of machines nevertheless consider themselves, with no more scientific study, authorities on the dynamics of the emotions of man.

Again, managers who are keen to use scientific methods in thinking about materials, abandon all semblance of science when thinking about people. How often we hear executives stating broad conclusions about human psychology as a result of a few conversations with taxi drivers, or with men in smokers, or with the bootblacks, or the waiters. "My wife and her friends tell me" is one of the most common grounds for conclusions of great moment.

In recent years, to be sure, extensive polls of public opinion have been developed. These represent a tremendous step in the scientific study of human satisfactions and irritations. However, these techniques are still young and at best give only superficial clues to people's true nature. What people will vote for today is little proof of how they will vote a year or two later. The majority today may favor security at the expense of opportunity. A few years later, a majority may favor opportunity rather than security.

International Cooperation in Management

THE RIGHT HONORABLE VISCOUNT LEVERHULME, *President International Committee of Scientific Management*
Governor of Lever Brothers, Ltd., London

IF WE AGREE that it is the fundamental objective of all good management to eliminate waste, both human and material, in every aspect of our economic life; if, in other words, it is manage-

why pay for E.P.* on an H.P. job?

(below 150 H.P.)

When a machine or pump manufacturer delivers his product and recommends a Coppus Turbine . . . he is working for his customers' best interests. For Coppus Turbines, built in 6 small sizes from 150 H.P. *down*, more often hit the horsepower requirements right — if it's a small job. No wasted initial cost . . . less maintenance through the years . . . safest possible power for explosive atmospheres. Individual nozzle control. Built-in speed reducers available for slow speed drives. The six prices (for the six sizes) are the lowest for any top-quality horizontal or vertical steam turbine you can buy. Address Coppus Engineering Corporation, 375 Park Avenue, Worcester, Mass., for Bulletin 135-8.

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Sales offices listed in THOMAS' REGISTER. Air Filters and Air Moving Equipment in SWEET'S.

This Shop Equipment is built to give you far more wear

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Fig. 732
Pat'd and
Pats. Pending.
Drawer extra.

Skillfully designed and built for present day needs. Its steel top stays smooth as a surface plate, and steel legs hold it permanently rigid. Bolt holes in the feet make it easy to fasten to the floor and easy to move. All its parts are standard and interchangeable. Best of all the cost is reasonable. Full range of sizes to choose from.

"HALLOWELL" STEEL STOOLS

The one piece welded steel construction of "Hallowell" stools and chairs makes them last longer — an important item when you're considering profits.

You can get just what you need in a "Hallowell" for the line is most extensive with a design adapted for use at any type of operation.

Fig. 1334
Pat. Applied for

"HALLOWELL" STEEL TOOL STANDS

Moves easily wherever it's needed; a handy stand to have. Made in a variety of types for all purposes.

Fig. 705

"HALLOWELL" FOREMAN'S DESK

Ideal for foreman's use. Right height . . . correct incline for writing while he's standing. Big drawer with lock for holding blue prints or records.

Fig. 981
Pat. Pending

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ment's task to get the greatest number of goods and services to the greatest number of people, then it is no longer possible for us to look at this problem nationally.

The spirit of rationalization is required no less urgently internationally than nationally. The mechanical evolution of the last century has created an economic interdependence between the countries of the world as much as between the individual enterprises within those countries. Whatever the emotional influence of nationalism and territorial sovereignty, the ever-increasing productivity of the machine, and the shrinkage of the world through more rapid and extensive communications, are facts which alter the economic significance of frontiers and which combine to produce a situation wherein the effects of a given source of waste can no longer be confined to the country wherein it exists. . .

Thus it is to the interest of every country in the world, and more particularly those countries with a large export business, that the economy of her neighbors should be as efficient as it is possible to make it.

It is consequently to the direct advantage of those countries, which are in a position to contribute most to the world's knowledge of management techniques, to make such contributions as energetically as possible and to facilitate the assimilation of their experience by those countries which have not yet progressed so far on the road to efficient management.

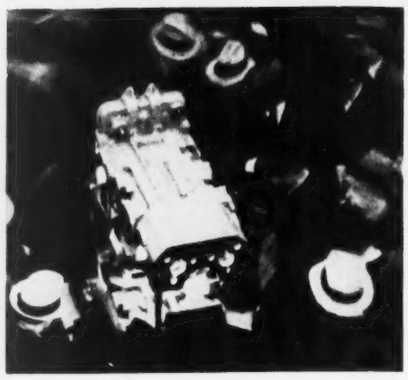
Human and Psychological Aspects of Management

ALEX BRULE
Vice-President, Comité National d'Organisation Francaise, Paris

PROFESSIONAL ORGANIZERS have sometimes forgotten this truth, which the great military chiefs never overlooked: Man is the basis of all work, and whatever the improvements of technology or scientific management, the human element will always play its part. There is no such thing as an industrial problem or a commercial problem—there is a human problem. The rules are the same everywhere, at all times and in all places. If the goal is to be hit, men must be scientifically selected; they must be physically trained for a given task. Man must be psychologically moved by a kind of mysticism which, let us hope, will one day be a mysticism of brotherhood, concord, and peace.

It is of the utmost importance that the wage earner should be carefully selected. We find ourselves in the presence of a new science which has made much progress during the past few years. . . But these methods are just in the making. They must avoid the dangers that threaten all human undertakings in their initial stages. . .

Social problems ought to be studied strictly from the professional angle. Political factors should be discarded and eliminated. Great improvements have already been realized in this direction,



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Only by seeing and comparing the equipment displayed, and discussing your problems with exhibitors' engineers, applying what you learn — only thus can you insure your security in the days ahead.

Over 40,000 engineers and executives are expected to attend this outstanding biennial event.

Of course you should be there. You will? Bring your associates and principal assistants.

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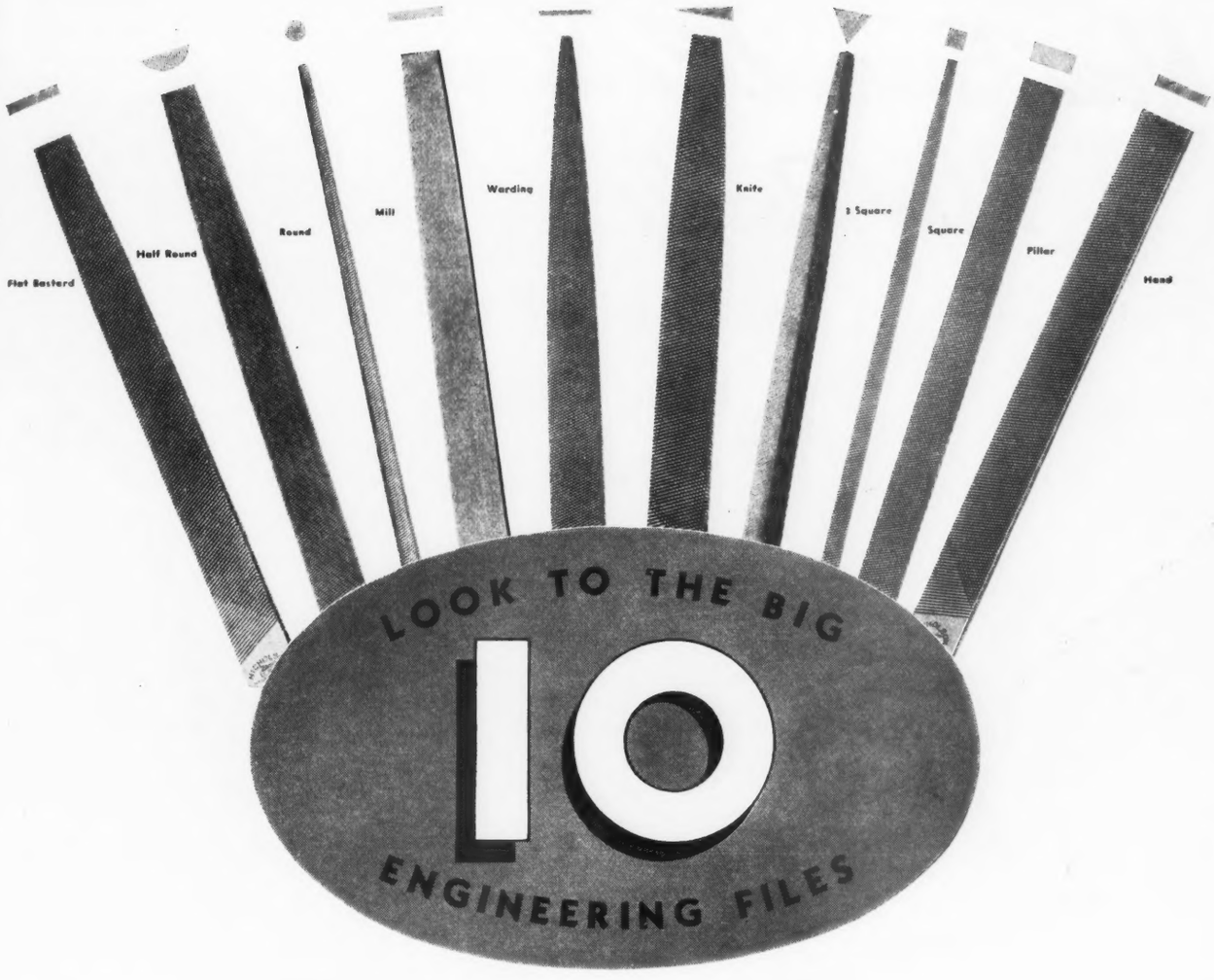

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Special file steel, uncompromising standards of uniformity in manufacture, a new tooth construction* that has made files more efficient than ever before — these are advantages making Nicholson, Black Diamond and McCaffrey Files a worthwhile investment for any plant with costs to cut. Ask your jobber for a trial order of the shapes, sizes and cuts that meet your needs. Nicholson File Co., Providence, R. I., U. S. A. Canadian Plant, Port Hope, Ont.

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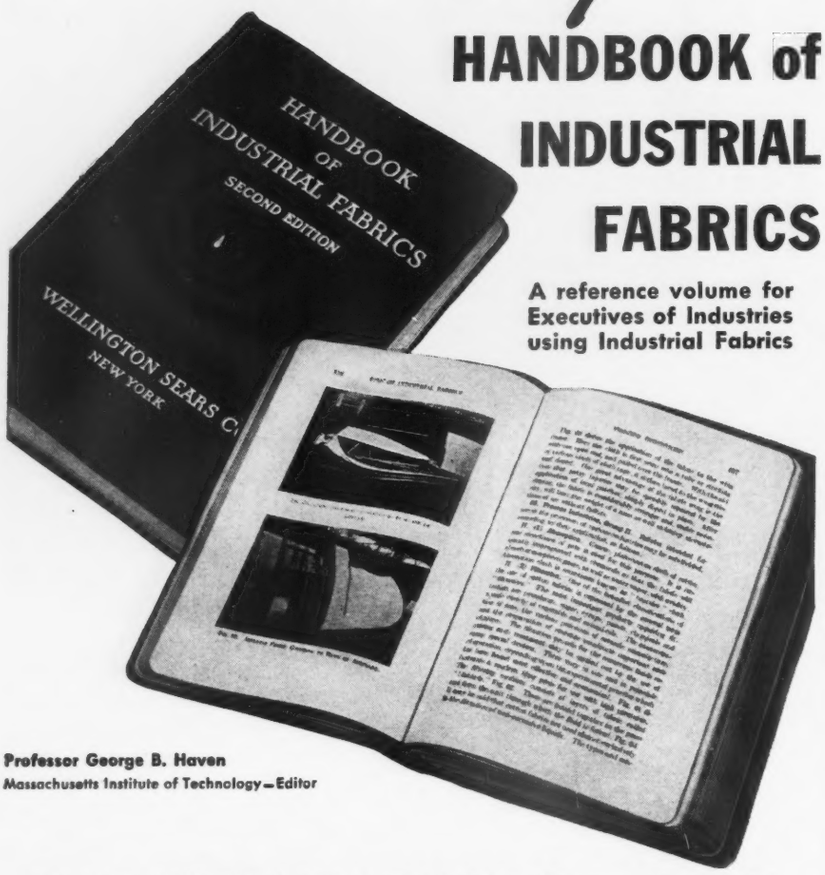
HANDBOOK of INDUSTRIAL FABRICS

A reference volume for Executives of Industries using Industrial Fabrics



Professor George B. Haven
Massachusetts Institute of Technology—Editor

The Revised Handbook of Industrial Fabrics will prove of particular interest and value to Executives of those industries which use industrial fabrics in manufacturing processes or in the fabrication of their products. Here in one handy volume is the only complete treatise on industrial fabrics that we know of. The first edition was adopted as a text book in textile courses in fourteen leading colleges and textile schools. This new edition contains 741 pages—hundreds of illustrations—the latest A. S. T. M. specifications for industrial fabrics, etc. A new chapter is added on use of the slide rule and nomographic charts.

Wellington Sears Company, the publisher, distributes the products of 17 modern cotton mills. These products include over 25,000 different cotton fabrics among which are: Numbered Duck, Army Duck, Single and Double Filling Duck, Wide sheeting, Twills, Drills and other cotton fabrics, standard or specification. Don't fail to send for your copy early. The edition is limited. You can have this valuable book for just $2.

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Gentlemen:
Enclosed please find $.....for.....copies of the new Revised Handbook of Industrial Fabrics, at $2. per copy. Postage extra outside U.S.A.

Name_____ Firm_____

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from the standpoint of a more rational production and distribution of goods.

Management must convince the worker that individual effort is necessary for the general welfare. On the other hand, while it is admitted that the worker is entitled to reasonable leisure and has the "right to work," the lawfulness of profit and the necessity of authority should be recognized by all.

The Influence of Technical Progress Upon Social Development

KARL T. COMPTON
President, Massachusetts Institute of Technology

TECHNICAL PROGRESS has created opportunities for cultural development, by affording the necessary time and facilities . . . In our day and generation, machines and mechanical power have taken the place of slaves in producing that large *per capita* productive power that makes possible time and money for education, recreation, pensions, short hours of labor, literature and news from all parts of the world, and travel. In the United States the mechanical power used is equivalent to an average of the full time work of fifty slaves for each person. . .

Every one of these desirable social developments can only be realized through the action of two forces, the force of better technical developments and the force of better management. Better technical developments call for scientific and engineering research, training and research workers, adequate funds and facilities, and time. Better management, whether in business or in government, provides adequate attention to scientific research, and requires better understanding of problems, wiser formulation of policies, and greater efficiency in their execution.

•

TRADE LITERATURE

Air Conditioning—Catalog CE–103A, on equipment for air conditioning, refrigeration, and space heating.—Carrier Corp., Syracuse, N. Y.

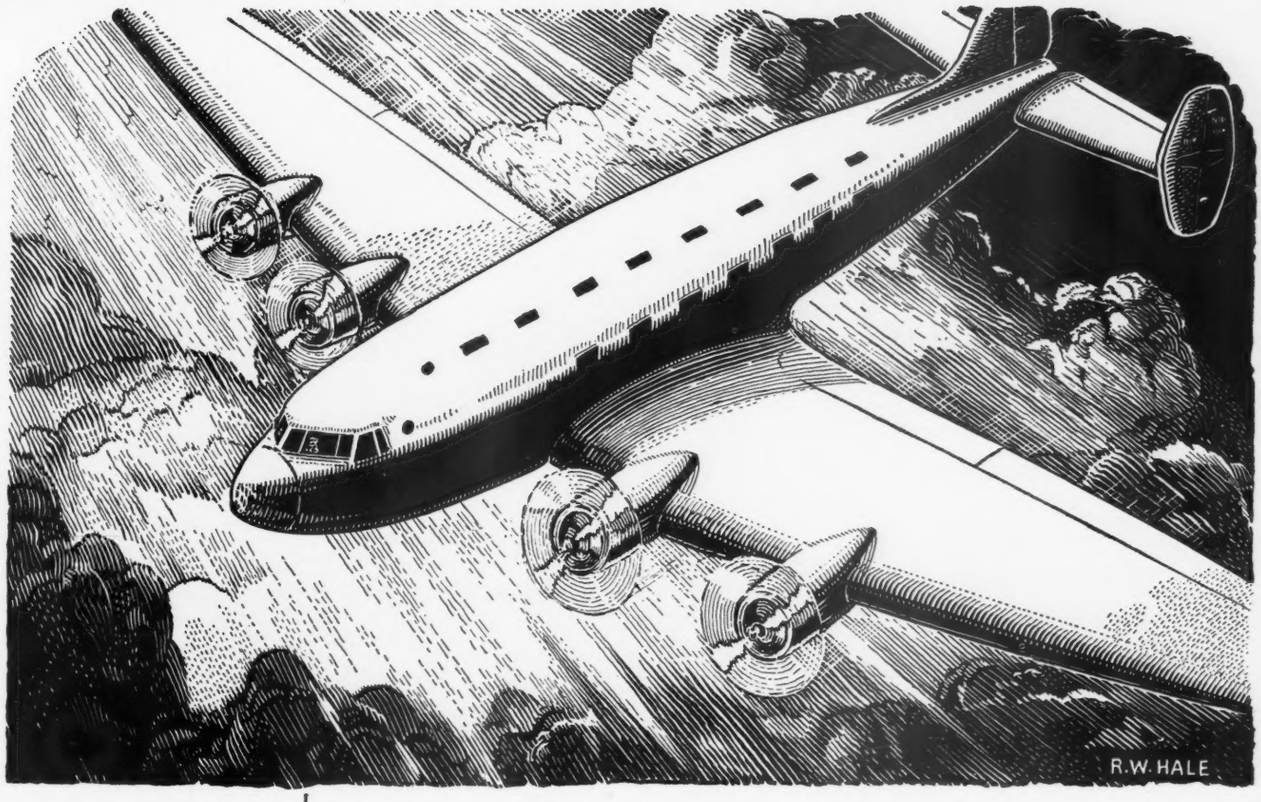
Bearings—Book No. 1652, on line of unmounted roller bearings.—Link-belt Co., 307 North Michigan Ave., Chicago.

Cast Iron—Bulletin, guide to selection of engineering specifications for grey cast iron to secure such qualities as density, hardness, strength, etc.—The International Nickel Co., Inc., 67 Wall St., New York.

Cement Cleaner—Folder, describing cement cleaner.—Magnus Chemical Co., Garwood, N. J.

Circuit Breaker—Descriptive Data 33-675, on Type U de-ion air circuit breaker.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Coil Winding Equipment—Folder, showing line of coil winding tools.—Ideal Commutator Dresser Co., 1234 Park Ave., Sycamore, Ill.



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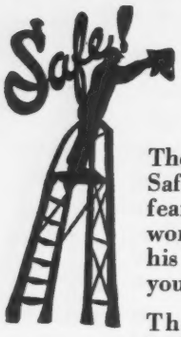

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Combustion Control—Bulletin No. 102–B, on air-operated combustion control.—Bailey Meter Co., 1050 Ivanhoe Road, Cleveland.

Compressed Air Trade Standards—Fifth edition of "Trade Standards—Compressed Air Industry." $1. Compressed Air Institute, 90 West St., New York.

Conveyor—Form G4–38, on Cleveland Tramrail conveyor.—The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

Conveyors—Catalog 35, showing gravity- and power-type package conveyors.—Logan Co., Louisville, Ky.

Coupling—Form No. 3219, describing traction-type hydraulic coupling.—Hydraulic Coupling Division of American Blower Corp., 632 Fisher Bldg., Detroit.

Dust Control—Two bulletins: No. 90 on cloth-type dust filter equipment, No. 91 on the "Centri-Merge" wet dust collector.—The W. W. Sly Mfg. Co., 4700 Train Ave., Cleveland.

Economizer—Bulletin 167, on Ringstay fuel economizer.—The Green Fuel Economizer Co., Inc., Beacon, N. Y.

Electrical Equipment—Catalog, listing switches, circuit breakers, starters, switchboards, and so on.—The Trumbull Electric Mfg. Co., Plainville, Conn.

Electrical Equipment—Catalog No. 383, covering controlling and distributing equipment for electric light and power.—Bull Dog Electric Products Co., Detroit.

Engine—Bulletin 10,011, describing Type PVG gas engine.—Ingersoll-Rand Co., 11 Broadway, New York.

Fans—Booklet No. X2472, showing design features of line of electric fans.—The Emerson Electric Mfg. Co., St. Louis.

Fans—Bulletin No. 103, title "Standard Test Code for Centrifugal and Axial Fans."—National Association of Fan Manufacturers, 5-208 General Motors Bldg., Detroit.

Fans—Bulletin 166, on mechanical draft fans.—The Green Fuel Economizer Co., Inc., Beacon, N. Y.

Fans—Folder, describing Unit Fans for ventilation and air circulation.—Carrier Corp., Syracuse, N. Y.

Felt—Two bulletins, on felts, felt washers, strips, pads, etc.—The Felters Co., Inc., 210 South St., Boston, Mass.

Files—Catalog R–49, showing more than 200 different kinds of files.—Grobet File Corp. of America, 3 Park Place, New York.

Firebrick—Booklet, covering boiler setting construction and refractory linings for boilers.—Plibrico Jointless Firebrick Co., 1800 Kingsbury St., Chicago.

Fire Protection—Two bulletins: "Supplement to January, 1938 List of Inspected Fire Protection Appliances" and "Supplement to December, 1937 List of Inspected Gas, Oil, and Miscellaneous Appliances."—Underwriters' Laboratories, Inc., 207 East Ohio St., Chicago.

Floor Armor—Form AD3, describing heavy-duty Floorsteel for floors subject to severe wear.—Acme Steel Co., 2840 Archer Ave., Chicago.

Flooring Material—Folder, on concrete surface treatment.—Stonhard Co., 410 North Broad St., Philadelphia.

Floor Treatment—Folder, on system for coloring and dust-proofing concrete floors.—The Truscon Laboratories, Detroit.

Forgings—Booklet, showing forgings, steel die sections, tool steel, and other products and services the company is ready to supply.—The Forging and Casting Corp., Ferndale (Detroit), Mich.

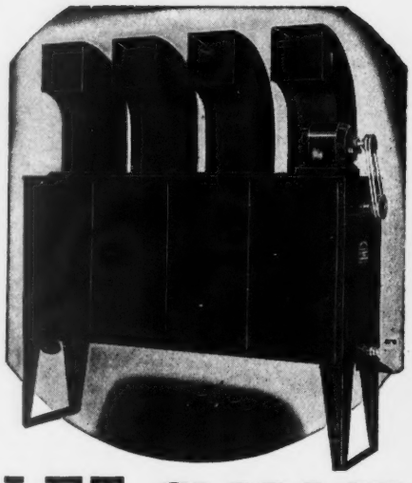
Fuses—Folder CPF-200 on fuses and accessories.—Trico Fuse Mfg. Co., 2948 North Fifth St., Milwaukee.

Gas Masks—Folder M-387, on full-vision gas masks.—Acme Protection Equipment Co., Inc., 3616 Liberty Ave., Pittsburgh.

Hard Surfacing—Folder, on No. 459 welding rod for hard surfacing.—American Manganese Steel Division of The American Brake Shoe & Foundry Co., 389 East 14th St., Chicago Heights, Ill.

Heaters—Bulletin No. 320, on gas heaters.—The Trane Co., La Crosse, Wis.

Hydraulic Tools—Folder, on Porto-Power hydraulic tools for pipe and con-



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duit bending and maintenance work.—Blackhawk Mfg. Co., Milwaukee.

Instruments—Catalog No. 1060D, on indicating, recording, and controlling instruments for temperature and pressure.—C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y.

Instruments—Catalog Section 43-370, showing miniature panel instruments.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Jack—Form No. 132-G, on lifting jacks for all general purposes.—Duff-Norton Mfg. Co., Pittsburgh.

Lighting—Booklet, title "Recommendations for Office Lighting."—The F. W. Wakefield Brass Co., Vermilion, Ohio.

Lighting Units—Booklet, title "Handbook of Localized Lighting."—The Fostoria Pressed Steel Corp., Fostoria, Ohio.

Materials Handling—Bulletin, on materials handling and mixing equipment.—Sprout, Waldron and Co., Inc., Muncy, Pa.

Materials Handling—Bulletin No. 138, on conveying machinery.—Gifford-Wood Co., Hudson, N. Y.

Mechanical Power Transmission—Bulletin No. A-207-B, on line of power transmission equipment.—Dodge Mfg. Corp., Mishawaka, Ind.

Mechanical Power Transmission—Catalog No. G-384, covering line of variable-speed control equipment.—Reeves Pulley Co., Columbus, Ind.

Motors—Folder, on Type N polyphase 1-1,500-hp. induction motors.—Burke Electric Co., Erie, Pa.

Plastics—Folder, announcing Bakelite cellulose-acetate molding materials.—Bakelite Corp., 247 Park Ave., New York.

Pumps—Bulletin, describing line of Fig. 3390 centrifugal pumps.—Goulds Pumps, Inc., Seneca Falls, N. Y.

Roof Coating—Folder, on Longlife asphalt roof coating.—Flexrock Co., 800 North Delaware Ave., Philadelphia.

Sanitary Equipment—Folder, describing Sanaphane toilet seat covers.—Ernest W. C. Toepfer, 2 Broadway, New York.

Screw Anchors—Catalog No. 38, showing types of anchors for bolts and screws in all kinds of material.—The Rawlplug Co., Inc., 98 Lafayette St., New York.

Signals—Bulletin No. 100, on horns, whistles, and sirens.—Edwards and Co., Inc., Norwalk, Conn.

Starters—Bulletin GEA-2954, on reduced-voltage a.c. magnetic starters.—General Electric Co., Schenectady, N. Y.

Steel—Booklet, title "Cutting Costs with Cold Drawn Steel."—Republic Steel Corp., Union Drawn Steel Division, Massillon, Ohio.

Switches—Bulletin 400, on line of open knife switches.—The Trumbull Electric Mfg. Co., Plainville, Conn.

Switches—Bulletin GEA-2963, on Type TSA-14 automatic time switches.—General Electric Co., Schenectady, N. Y.

Thermometers—Bulletin T11A, on all-metal thermometers.—Weston Electrical Instrument Corp., Newark, N. J.

Transformers—Catalog Section 43-131, on Type PV-130 portable voltage transformers.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Turbine—Bulletin H-11, on Type CY turbine for mechanial drive.—Elliott Co., Jeannette, Pa.

Valves—Booklet, title "Checking Up on Check Valves."—Crane Co., 836 South Michigan Ave., Chicago.

Vibration Insulators—Catalog Section 7900 on Vibro-Insulators.—Mechanical Rubber Goods Division, The B. F. Goodrich Co., Akron, Ohio.

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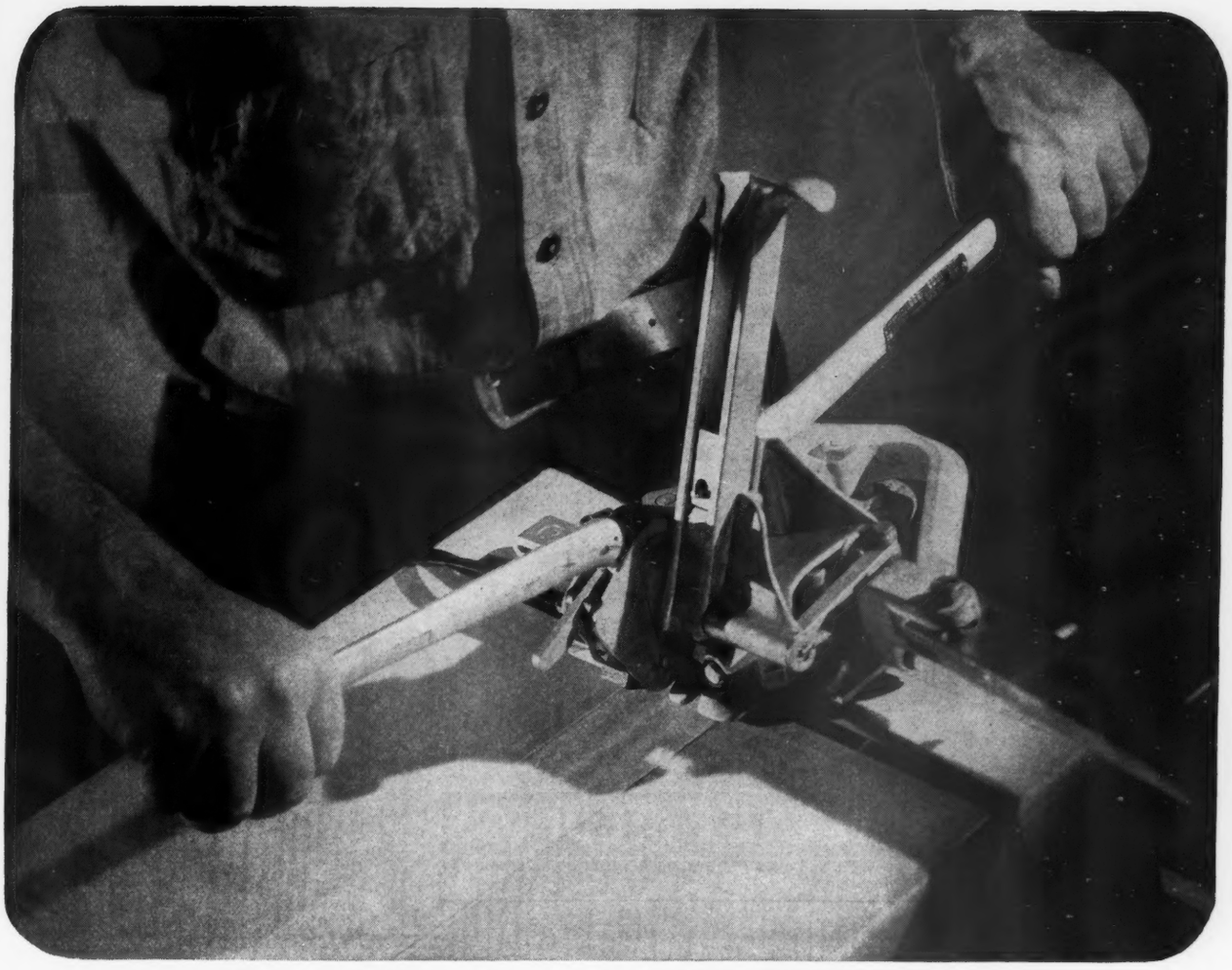
BOOKS

THE SCIENCE OF PRODUCTION ORGANIZATION

E. H. Anderson and G. T. Schwenning, respectively Assistant Professor and Professor of Business Administration at the University of North Carolina.



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John Wiley & Sons, Inc., 440 Fourth Ave., New York. 273 pages, bibliography, index. $3.50.

The authors have made a comprehensive search of written material on business organization, and in this book cite the differing views and try to reconcile them. It is a work devoted entirely to the subject of organization, and in the process of presenting its thesis attempts to harmonize the philosophy of scientific management and economic theory.

FOREMANSHIP AND SUPERVISION

Frank Cushman, Consultant in Vocational Education, United States Department of the Interior. John Wiley & Sons, Inc., 440 Fourth Ave., New York. 286 pages, index. $2.50.

Second edition of this handbook for foreman conference leaders and supervisors of vocational education contains additional material representing ten more years of the author's experience in the field. Method of conducting foreman training by the conference method is treated in detail, and sample conference material is included. There is a new chapter entitled "Some Fundamental Principles of Good Supervision."

ELEMENTS OF LABOR POLICY

Bureau of Industrial Relations, University of Michigan, Ann Arbor, Mich. Bulletin No. 7. 70 pages. $1.

In the spring of this year the Bureau of Industrial Relations sponsored two conferences on industrial relations. The speeches delivered there are summarized in the articles in this bulletin. Clarification of labor policies, education and training, performance standards, wage and salary policy, and layoff policy are among the subjects singled out for treatment.

COLLECTIVE BARGAINING AND COOPERATION

Bureau of Industrial Relations, University of Michigan, Ann Arbor, Mich. Bulletin No. 80. 65 pages. $1.

Other addresses made at the same conference on industrial relations mentioned in the preceding announcement appear in this bulletin. Titles of the individual papers: "Economic Conditions and Collective Bargaining," "Experiences in Collective Bargaining," "Problems in Collective Bargaining," "The Employee's Right to Bargain Individually with Management," and "Collective Cooperation Between Management and Labor."

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ON THE CALENDAR

OCTOBER

5–7, American Society of Mechanical Engineers, Fall Meeting, Providence, R. I. C. E. Davies, Secretary, 29 West 39th St., New York.

10–14, National Safety Council, Annual Meeting, Chicago, W. H. Cameron, Secretary and Managing Director, 20 North Wacker Drive, Chicago.

17–21, American Welding Society, National Metal Exposition, Detroit. M. M. Kelly, Secretary, 33 West 39th St., New York.

24–28, National Electrical Manufacturers Association, Annual Meeting, Chicago. W. J. Donald, Managing Director, 155 West 44th St., New York.

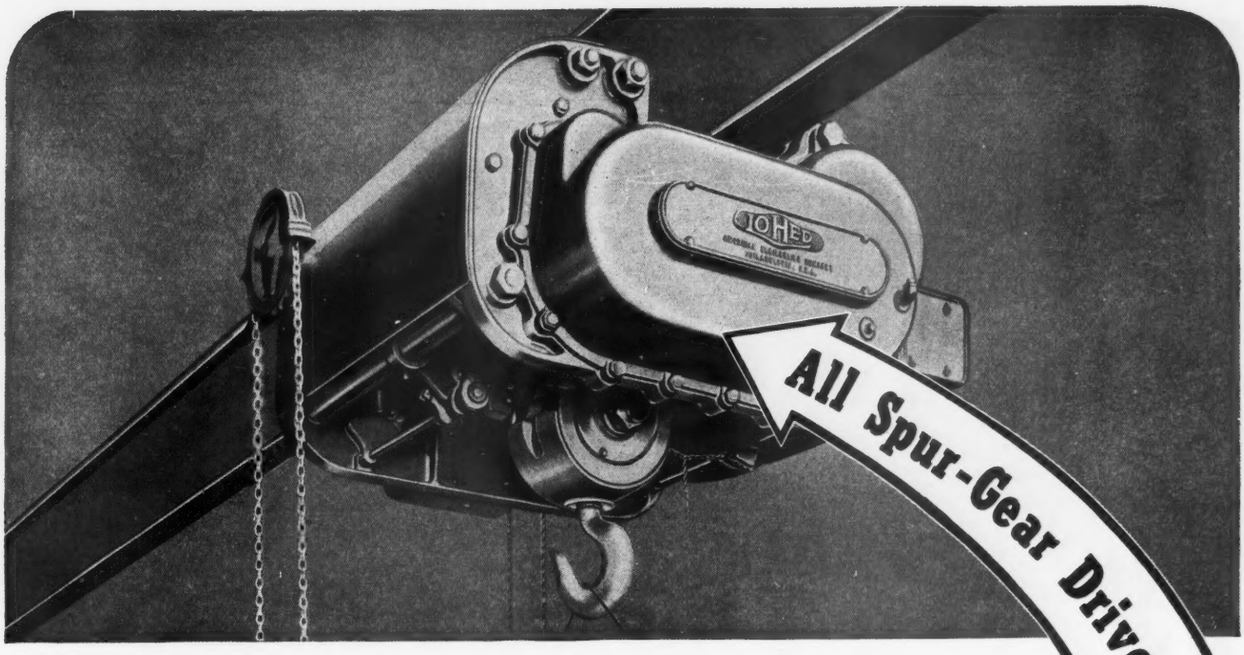
DECEMBER

5–9, National Association of Manufacturers, Annual Congress of American Industry and National Convention, New York. Noel Sargent, Secretary, 14 West 49th St., New York.

5–9, American Society of Mechanical Engineers, Annual Meeting, New York. C. E. Davies, Secretary, 29 West 39th St., New York.

5–9, The Society for the Advancement of Management, Annual Conference, New York. Evelyn Buckley, Assistant Secretary, 29 West 39th St., New York.

5–10, Thirteenth National Exposition of Power and Mechanical Engineering, New York. Charles F. Roth, International Exposition Co., Grand Central Palace, New York.



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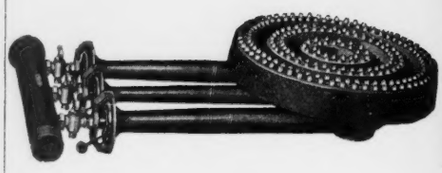

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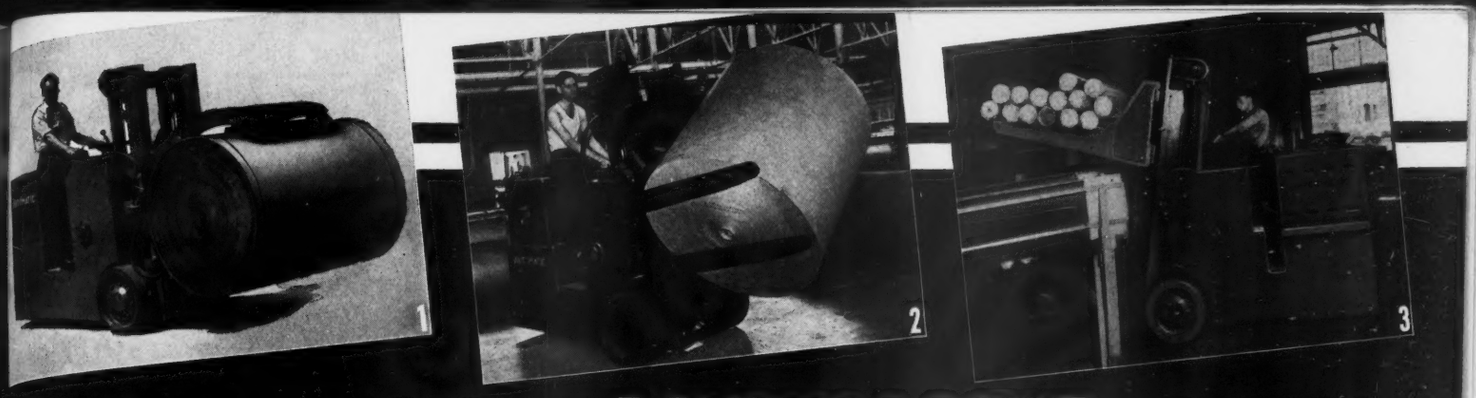

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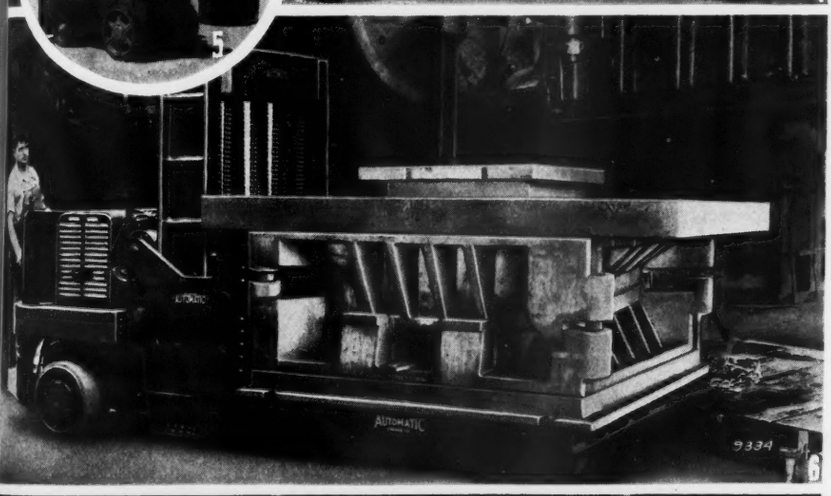


ARE SAFE — PRACTICAL — ECONOMICAL AIDS TO LABOR

Since its inception "AUTOMATIC" has continually applied new scientific research and engineering technique combined with modern production methods to develop new modern type Electric Materials Handling Equipment as *Aids to Labor*.

Illustrated here are some of the many "AUTOMATIC" types which have made it possible for Labor to accomplish *MORE* work with *LESS* EFFORT. These have likewise made it possible for Management to pay higher wages for less hours of work.

Thus "AUTOMATIC" Electric Trucks of every description have immeasurably contributed to better labor conditions in American Industries through their ability to operate with safety and efficiency. They have removed the accident hazards from laborious work.

Perhaps one of these "AUTOMATIC" trucks shown is just the type you need now!!! Write today for full details and prices, without obligation.

1. Motorized Roll Clamp Attachment Facilitates (one man roll handling).
2. Center-control truck with motorized revolving paper roll device.
3. Center-control truck with special forks to suit individual requirements.
4. Center-control telescopic tilting tiering fork trucks (capacities up to 10,000 lbs.).
5. Revolving barrel grapple swivel attachment facilitates (one man barrel handling).
6. Heavy-Duty Motorized Die Handling Trucks. Capacities up to 30 tons.
7. Heavy-duty low-lift platform truck with motorized conveyor platform.

AUTOMATIC TRANSPORTATION CO.
39 WEST 87th STREET
CHICAGO, ILL.

WHEN YOU BUY TRUCKS - - *Buy* "AUTOMATIC"

1938
MANAGEMENT OBJECTIVES

Insure Against Your Greatest Hazard—The N. B.!*

THE GREATEST ASSET of any business is its friends who buy and use the product. But they are on the *march*—on—or up—or out! There is conservatively a 35% turnover among Industry's engineers and executives every year, including the normal quota of discharges, resignations, retirements, deaths, transfers, promotions, demotions and—the N. B.*

The greatest hazard to any business is the *NEW BUYER. Like a new broom he often sweeps clean—sweeps out the ideas and methods of his predecessors—installs his own. No sales organization can locate in advance and cultivate all the N. B.'s. Only advertising can do that.

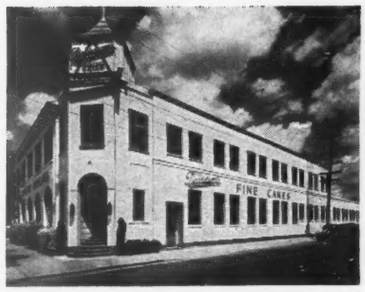
To insure against your greatest hazard—ask your advertising agency whether your appropriation is adequate to accomplish this objective.

Published in the interests of greater sales, employment and profits in 1938 by the
McGRAW-HILL PUBLISHING COMPANY, INC., NEW YORK, N.Y.

600 Visitors A Week

...And One Thing They Always Notice Is The Clean Hard Maple Floors!

Writes **Mr. E. F. DAVIDSON,** *President,*
Davidson Baking Co., Portland, Oregon



Mr. Davidson says:
"Hard Maple is by far the most economical floor to service and keep in good appearance... About 120 women visit our bakery every day and one thing they always notice is the hardwood floor. They know that hardwood floors in a home are the very best, and they realize the Hard Maple floor means we take pride in our bakery."

MFMA Northern Hard Maple floor in The Davidson Baking Company, Portland, Oregon

BAKERY floors are bought for cleanliness and economy—not for advertising value. But when you pick *Northern Hard Maple,* you get both.

For Hard Maple's smooth surface holds no dust, offers *natural* sanitation. To visitors, its spic-and-span appearance plainly says, "This plant is *clean!*" Employees, too, appreciate Maple. Warm, dry, easy to work on, it reduces fatigue, increases efficiency.

And for economy, Hard Maple has no equal. Like bakeries, countless factories have proved its remarkable resistance to abrasion and indentation; it does not sliver, splinter, or develop ridges through the years. Hard Maple creates no dust, simplifies alterations, anchors machinery firmly — is simple and inexpensive to maintain — and, properly finished, is cleaned by brushing alone.

Before building or remodeling, investigate this most-logical service flooring. And when you buy, be sure it's **MFMA*** Northern Hard Maple (the Association-guaranteed Maple)—available in strips or blocks.

MAPLE FLOORING MANUFACTURERS ASSOCIATION
1787 McCormick Building, Chicago, Illinois

See our catalog data in Sweet's, Sec. 11/76.
Write for folder describing good service finishes for old or new Hard Maple floors.

To be sure of Association guaranteed grading, specify and look for the* **MFMA *trademark (indented and stamped). The following manufacturers are licensed to use it:*

•

Beck, August C. Co., Milwaukee, Wis.
Brown Dimension Co., Manistique, Mich.
Bruce, E. L. Co., Memphis, Tenn. (Mill at Reed City, Mich.)
Connor Lumber & Land Co., Laona, Wis. (Sales Office, Marshfield, Wis.)
Farrin Lumber Co., M. B., Cincinnati, O.
Holt Hardwood Co., Oconto, Wis.
Kerry & Hanson Flooring Co., Grayling, Mich.
Kneeland-Bigelow Co., Bay City, Mich.
Kneeland-McLurg Flooring Co., Phillips, Wis.
North Branch Flooring Co., Chicago, Ill.
Oval Wood Dish Corp., Tupper Lake, N. Y.
Robbins Flooring Co., Rhinelander, Wis.
Stephenson Company, I., Wells, Mich.
Wells, J.W. Lumber Co., Menominee, Mich.
Wisconsin Land & Lbr. Co., Hermansville, Mich.
Yawkey-Bissell Lumber Co., White Lake, Wis.

Floor with **MFMA Maple**
(NORTHERN HARD)

NEW!

Tells How to Solve FLOOR MAINTENANCE Problems *Economically*

This easy, economical way to avoid floor maintenance costs and troubles is fully described in the new Floorsteel file booklet. It pictorially tells how many leading companies prevent dangerous cracks and holes—and at the same time provide permanently smooth, quiet, non-skid floors by installing Acme Heavy-Duty Floorsteel.

Imbedded flush with the surface in concrete, asphalt or other suitable material, Acme Floorsteel takes the brunt of rolling loads and reduces surface wear to a minimum. The small mesh is so formed that even the smallest truck wheels will ride on three or more of the steel ribs, which "mushroom" slightly and actually become stronger with use. Furnished in standard rolls in 47½", 60" and 72½" widths and 25 ft. in length, Acme Floorsteel is easily and quickly installed by your own men.

Inspect this floor armoring that adds years to the serviceable life of industrial floors.

Find out how little Acme Floorsteel costs in terms of trouble-free floor protection. Send for a copy of the new booklet. There is no obligation and it may be the means of making *big* savings.

ACME HEAVY DUTY FLOORSTEEL

MAIL THE COUPON FOR YOUR FREE COPY

ACME STEEL COMPANY,
2831 Archer Ave., Chicago, Ill.
( ) Send the new Acme Floorsteel booklet.
( ) Send FREE sample section of Acme Floorsteel.

Name .....

Address .....

City ..... State .....

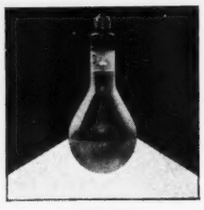
BETTER LIGHTING ... LESS LINE LOAD

This Free Booklet Shows How to Get Both

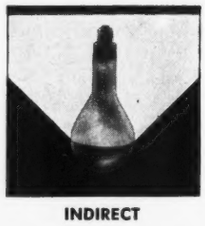
Independent tests made by front-rank industrials prove you can cut your lighting costs and get Better Lighting with Birdseye Reflector Lamps. These lamps screw right into existing sockets and control the light at its source without exposed, grime-collecting reflectors.

Bright, pure silver sealed *inside* the bulb directs the light to the work plane undiminished by dirty or surface-worn reflectors. You get more usable light with less line load and costly fixture cleaning is eliminated.

Write for booklet, "Advanced Industrial Illumination." It tells a convincing story of Better Lighting and reduced lighting costs.

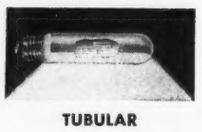


DIRECT
All beams directed downward.



INDIRECT
All beams directed upward.

INTENSIFYING SPOTLITE
An intense beam with moderate diffusion.



TUBULAR
Side-Silvered for bench lighting.

BIRDSEYE
REFLECTOR LAMPS

Inside-Silvered • Self-Reflecting

100 East 42nd St. BIRDSEYE ELECTRIC CO. *New York, N. Y.*

Reg. U. S. Pat. Off. *Factory: Gloucester, Mass.*

SPEED . . . plus Control

LIMITORQUE
AUTOMATIC
VALVE CONTROL

gives you both

Valve operation, like baseball playing, is at its best only when Speed and Positive Control are combined. The Limitorque mechanism will open or close globe, gate, Penstock, rotary plug and many other types of valves, much faster than the same operation can be done manually, yet it is so adjusted that absolute assurance against improper valve seating is always provided. If any obstruction whatsoever should be met at any point in the operation, a positive safety overload mechanical cutout instantly disconnects the motive power and thus preventing chipped valve gates or bent, or otherwise damaged valve stems.

Limitorque can be adapted to any make valve . . . will fit existing equipment.

Write for Literature

PHILADELPHIA GEAR WORKS

Industrial Gears and Speed Reducers

ERIE AVENUE AND G STREET, PHILADELPHIA

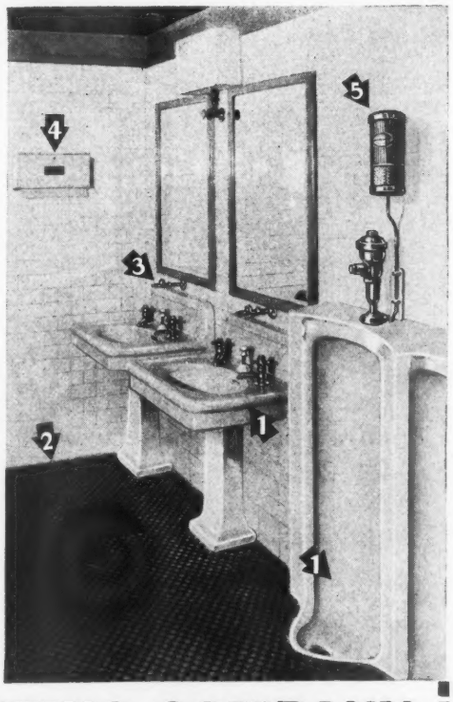
PROVIDE PROPER WASHROOM SANITATION

1 No matter how efficient automatic deodorizing devices may be, the daily or routine use of a cleansing disinfectant such as CORO-NOLEUM on washroom floors, basins, seats, etc., is important.

2 As all floor surfaces are more or less porous, it is necessary to seal them. Washroom floors finished with FILPOR will not only help prevent destructive elements from entering the pores of the floor, but will always look better and be easier to keep clean.

3 The use of liquid soap, besides being sanitary and efficient, eliminates waste. The WEST LATHERATOR VALVE automatically agitates the soap into a rich creamy lather *before* it leaves the valve, thereby saving the usual waste, as none of the soap runs off the hands. Latherator Valves can be installed in your present system at small cost.

4 The West Disinfecting Company manufactures a complete line of paper towels from fresh, clean pulp in its own mills. Standardized quality is obtained by expert scientific manufacturing control. West towels are made in either Junior or Senior sizes and in 32 lb. or 38 lb. basic weights. In addition, the TANDEM (double towel) is obtainable and is popular with commercial organizations where costs are carefully checked.



5 An efficient method of deodorization in lavatories is the WEST AUTOMATIC DRIP MACHINE. The special drip fluid spreads on the surface of the water, and helps overcome bad odors at the source. The results obtained through the use of this modern apparatus have been so thoroughly satisfactory that it has been recognized as a most practical, economical and efficient method for elimination of washroom odors.

For literature on above products, send coupon below.

WEST DISINFECTING COMPANY

42-16 BARN STREET • LONG ISLAND CITY, N. Y.

West Disinfecting Company
Dept. J, 42-16 Barn St., Long Island City, N. Y.

Please send literature on promotion of washroom sanitation.

Name_____

Position_____

Organization_____

Street and No._____

City and State_____

Scene in Chicago plant of the Hedman Mfg. Co., makers of F. & E. Check Protectors.

30,000 HOLES A DAY

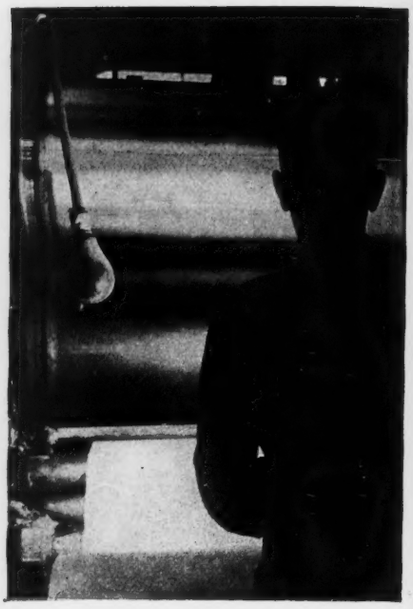
That's the day-by-day job of the Delta drill presses and tapping equipment shown here, in the Chicago plant of the Hedman Manufacturing Company, makers of the famous F. & E. Check Protectors. 30,000 holes tapped per day, with 3-48 and 6-32 taps—in steel—with astonishing low tap breakage—at 2250 to 5000 r.p.m.

This is only one instance of the ways in which Delta LOW COST drilling and tapping equipment is saving money for thousands of alert manufacturers.

Consider these advantages of Delta Drill Press—Low first cost, economical operation, low maintenance cost, portability, flexibility, compactness, and prompt delivery—and see if you cannot cut your production costs by adopting these efficient light power tools. Write today for the full story of other installations, specifications and prices on the complete line of Delta Drill Presses.

Delta Mfg. Co.

691 E. Vienna Ave.
Milwaukee, Wis.



Back up your sales story with PERFORMANCE PHOTOS

If your salesmen could show your product in actual use, how much easier it would be to demonstrate its good points and describe its operations.

Performance photos enable you, in effect to take your prospective customers to some other users plant . . . to show your product in actual operation.

They speak a language everyone understands and put punch into your advertising.

Send for illustrated booklet and costs.

. Photographic and Illustration Dept.

McGRAW-HILL PUBLISHING CO., Inc.
330 West 42nd Street
New York, N. Y.

Gilfillan Radio Corp. uses "Grip-Tread" *Mastipave* around all dangerous machinery.

SAFETY starts with "Grip-Tread" FLOORS...

Maybe industrial workers don't "walk off the job" when a serious accident happens. Yet every accident weakens morale, reduces efficiency, causes loss of time, costs money!

To reduce accident hazards, install *Grip-Tread Mastipave*, the new safety floor covering. In addition to its safety feature, *Mastipave* is the ideal industrial floor covering from many another angle.

It's water-proof, rot-proof, vermin-proof... self-healing if cut or scratched ... tough, yet resilient underfoot ... impervious to most acids and chemicals ... unbelievably durable! Good-looking, too! Moderate in first cost ... maintenance practically *nil!*

It's something that every maintenance man should know about!

Mastipave *Contract Service, for areas of any size, available in any part of the United States.*

If you would like to know more about

GRIP-TREAD MASTIPAVE

Send the Coupon!

821

THE PARAFFINE COMPANIES, INC.

Dept. 25-FM, San Francisco, Calif. (or) Somerville, N. J.

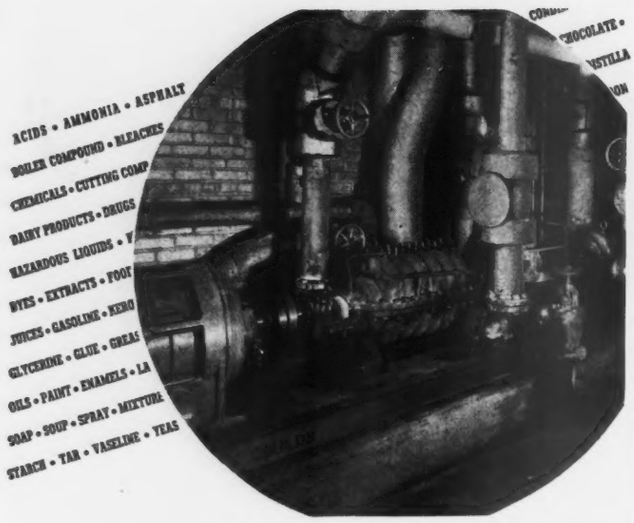
☐Send illustrated booklet. ☐Have representative call

☐Send name of nearest contractor

Name..... *Title*.....

Company.....

Address.....


ACIDS • AMMONIA • ASPHALT
BOILER COMPOUND • BLEACHES
CHEMICALS • CUTTING COMP
DAIRY PRODUCTS • DRUGS
HAZARDOUS LIQUIDS • V
DYES • EXTRACTS • FOOT
JUICES • GASOLINE • KERO
GLYCERINE • GLUE • GREAS
OILS • PAINT • ENAMELS • LA
SOAP • SOUP • SPRAY • MIXTURE
STARCH • TAR • VASELINE • YEAS

. . . AND FOR WATER PUMPING SERVICE

Goulds Fig. 3330 Multi-Stage Centrifugal Pumps have demonstrated over and over again that they are unsurpassed as boiler feed water pumps.

The above Goulds Fig. 3330 Multi-Stage Centrifugal Pump installation at the Fifth Street Power Plant of the Board of Public Works, Holland, Michigan is used on boiler feed service. The pump capacity is 150 G.P.M. at a head of 660 feet. Its adaptability to Power Plant use, long life, and dependability make for greater pump efficiency.

Fig. 3330 is an outstanding example of a line that, over a period of many years, has established an unmatched record for reliability and low cost operation.

Built in capacities of 40 to 2,000 G.P.M., this pump finds wide application for general water supply, boiler feeding, pressure service, circulating systems and many other uses for pressures up to 370 pounds.

Bronze fitted, all iron and all bronze construction offset the corrosive action of commonly used liquids.

Write for your copy of Bulletin No. 201-A today.

GOULDS PUMPS Inc.

ATLANTA BOSTON CHICAGO HOUSTON NEW YORK PHILADELPHIA PITTSBURGH TULSA Representatives in all Principal Cities

8403

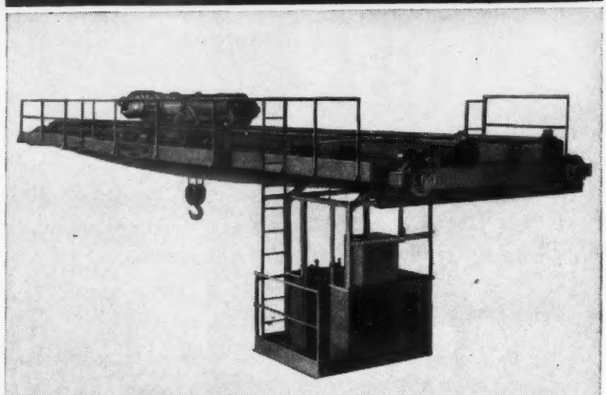
LABOR COSTS CUT 60% TO 70% *when* NITROSE *. . . is used*

Nitrose can be applied with only a third the labor ordinarily required. No expensive preparatory work necessary — no second coat needed when you use this time-tested protective covering for metal surfaces. Effectively resists corrosion under severe conditions — offers long-time protection in general maintenance work at no more cost than ordinary paints. Write

THE NITROSE CO., INC. • PEORIA, ILL.

ELECTRIC TRAVELING CRANES

1 TO 450 TONS CAPACITY



Every Detail of the Most Advanced Design

SHEPARD NILES CRANE & HOIST CORP.

364 SCHUYLER AVENUE, MONTOUR FALLS, N. Y.

A COMPLETE LINE OF CRANES AND HOISTS

"Have you heard of the wonderful one-hoss shay,
That was built in such a logical way
It ran a hundred years to a day?"

INDUSTRY IN MASSACHUSETTS

TODAY AS ALWAYS

STILL BENEFITS FROM CONSCIENTIOUS CRAFTSMANSHIP

Just as in the days when Oliver Wendell Holmes' worthy deacon built himself the perfect chaise, labor in Massachusetts continues to be proud of its skill. Thousands of intelligent workers with that splendid heritage of pride in a job well done still contribute a priceless asset to industry in this State.

But, the opportunity of employing the best and most level-headed labor in the world is but one of the advantages Massachusetts bestows on industry. Within the compass of 500 miles from the heart of Massachusetts are most of the major markets of the North American continent — reached in 24 hours or less, linked by improved highways, rail, water and air.

In every way, industrial-minded Massachusetts encourages industry. Manufacturing corporations here enjoy the lowest taxes of any industrial state, and Massachusetts banks, long familiar with industrial needs, stand ready to support any industry new or old which justifies their aid. Special steps have been taken to provide ready financing for industries to settle here.

Massachusetts invites new industries and offers unparalleled inducements. Write for "Industrial Advantages of Massachusetts", a brief, readable book of accredited facts.

THE MASSACHUSETTS DEVELOPMENT AND INDUSTRIAL COMMISSION · STATE HOUSE, BOSTON, MASSACHUSETTS

IT'S PROFITABLE TO PRODUCE IN MASSACHUSETTS

● Brings traditional Toledo Accuracy to your important repeat-weighing and checking operations. Its superior features include:

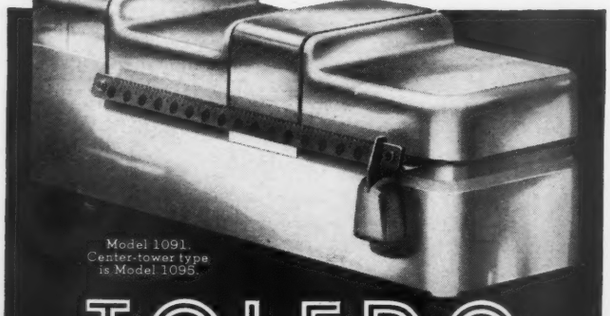
Rugged Construction—wide-spaced, super-size pivots and bearings. Heavy-duty, self-adjusting dash pot.

Ready-To-Use Anywhere—carrying handle is in-built. Scale weighs accurately even when out-of-level. Light in weight, compact in dimensions.

Distinctive Design—Lever and vital working parts *within* housing. Exterior is polished, die-cast aluminum.

Choice of Models—center-tower or end-tower types. Both have 1" to oz. indicator travel. Sensitive to 1/64 oz. Special platters, scoops, etc. for specific requirements.

Write for a demonstration, or detailed information.



Model 1091. Center-tower type is Model 1095.

TOLEDO SCALES

TOLEDO SCALE COMPANY · TOLEDO, OHIO

Sales and Service Offices in Principal Cities.

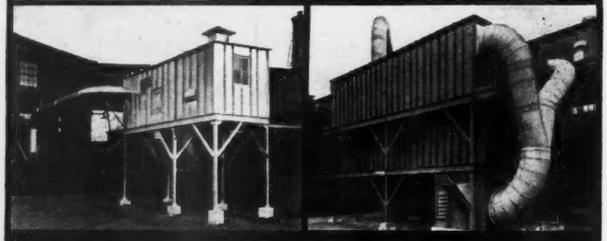
CONTROL

THE DUST HOG—
TURN HIM INTO PROFIT

● A double Saving is yours when you control Dust with Pangborn Dust Collectors.

First, the Saving from damages which the Dust Hog always brings—and second, the Saving arising from the salvaging of valuable materials.

More than 4400 Pangborn Dust Collectors are controlling dust today; efficiently, safely, and economically. Pangborn engineers can do a good job for you, too. Whether your problem is big or small—it will pay you to "come to Pangborn". Write today.



PANGBORN

THE WORLD'S LARGEST MANUFACTURER OF DUST CONTROL AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION · HAGERSTOWN, MD.

Where RUST rides the roads HOT-DIP GALVANIZING is needed

With the development of our elaborate highway systems, come heavy repair and maintenance costs. Steel must replace weaker materials and hot dip galvanizing must close these roads to rust . . . In concrete armoring, safety guards, poles, posts, railings, curb bars, culverts and light hardware, hot dip galvanized steel unquestionably serves more efficiently and at less cost . . . Patronize members of this association and know that you are getting a quality hot dip job handled by expert personnel in a modernly equipped plant . . . American Hot Dip Galvanizers Association, Inc., American Bank Building, Pittsburgh, Pa.

IF IT CARRIES THIS SEAL IT'S A JOB WELL DONE

Acme Galvanizing, Inc., Milwaukee, Wis.
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
American Tinning & Galvanizing Co., Erie, Pa.
Atlantic Stamping Co., Rochester, N. Y.
Buffalo Galvanizing & Tinning Wks., Inc., Buffalo, N.Y.
Columbian Steel Tank Company, Kansas City, Mo.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Enterprise Galvanizing Co., Philadelphia, Pa.
The Fanner Mfg. Company, Cleveland, Ohio
John Finn Metal Works, San Francisco, Cal.
Thomas Gregory Galvanizing Works, Maspeth, N. Y.
Hanlon-Gregory Galvanizing Co., Pittsburgh, Pa.
The Hodell Chain Company, Cleveland, Ohio
Independent Galvanizing Co., Newark, N. J.
International Derrick & Equipment Co., Columbus, Ohio
Joslyn Co. of California, Los Angeles, Cal.
Joslyn Mfg. & Supply Co., Chicago, Ill.
L. O. Koven & Brother, Inc., Jersey City, N. J.
Lehigh Structural Steel Co., Allentown, Pa.
Missouri Rolling Mill Corp., St. Louis, Mo.
The National Telephone Supply Co., Cleveland, Ohio
Penn Galvanizing Co., Philadelphia, Pa.
Riverside Foundry & Galvanizing Co., Kalamazoo, Mich.
San Francisco Galvanizing Works, San Francisco, Cal.
The Sanitary Tinning Co., Cleveland, Ohio
Standard Galvanizing Co., Chicago, Ill.
Wilcox, Crittenden & Co., Inc., Middletown, Conn.
The Witt Cornice Co., Cincinnati, Ohio

"Ours Is the Best in the Lot"

"The best investment we have made", writes a large west coast sand and gravel company, "was the purchase of our Industrial Brownhoist crane. It has proved very economical in operation and is always ready to do its work. In and around Olympia are several cranes of different makes but, without hesitation, we say ours is the best in the lot."

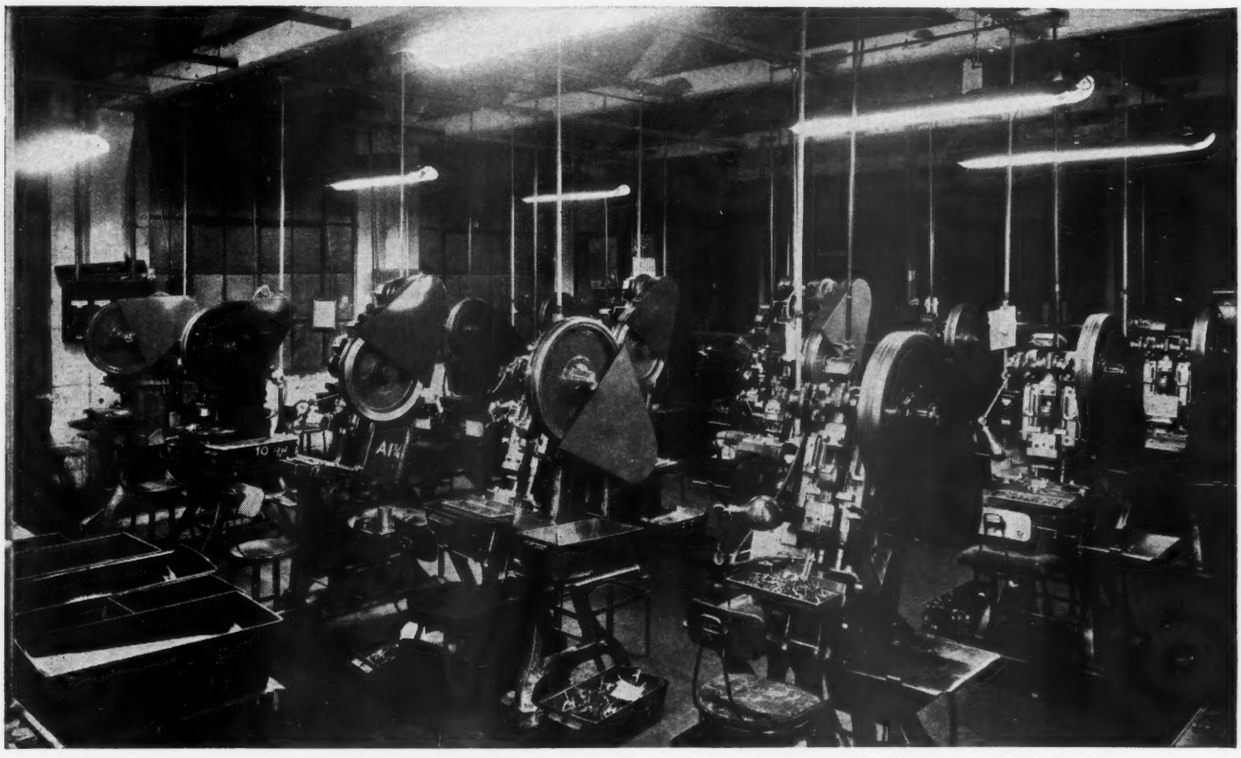
Modern crane equipment invariably pays real dividends. The new Industrial Brownhoists are proving this every day in handling all kinds of materials with bucket, hook or magnet and in switching cars. It is a comparatively simple matter to compare your present costs with those of "the best in the lot." We will be glad to help you do this and to give you all the facts about an Industrial Brownhoist of just the right type and size for your work.

INDUSTRIAL BROWNHOIST

GENERAL OFFICES: BAY CITY, MICHIGAN
DISTRICT OFFICES
New York, Philadelphia, Pittsburgh, Cleveland, Chicago,
Agents in Other Principal Cities

Victoria
TOILET TISSUES

TOOLED UP with detail-revealing light



...FOR PROFIT PRODUCING PRODUCTION

Manufacturers in ever-increasing numbers consider light one of their most important production "tools." Employees see better . . . think better . . . feel better . . . and work better . . . when lighting is *engineered to fit the job.* It's the one efficiency item in a plant production schedule that everybody welcomes.

Workers and employers both consider Cooper Hewitts the finest industrial light. Shadows are virtually non-existent. The long-tube light sources are naturally low in glare factor. High illumination levels that promote good seeing and good work can thus be achieved without eye-stabbing reflections from bright metal parts.

"High seeability" lighting is less expensive than ever before. Why not discuss the possibilities of "tooling up" with detail-revealing light for profit-producing production. You'll profit. For complete information write to ...General Electric Vapor Lamp Company, 815 Adams Street, Hoboken, New Jersey.

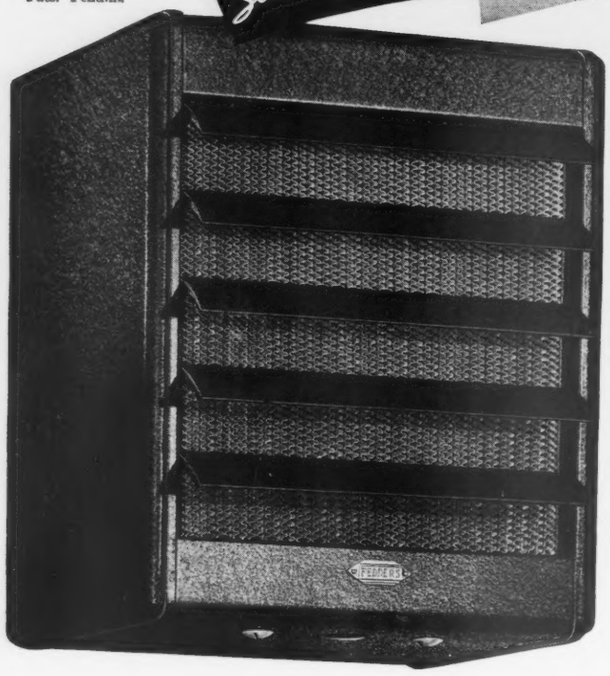
Modern Cooper Hewitt lights are more efficient in every respect than ever before. Let us give you the facts about this long, detail-revealing light source which more than a million workers and their employers now enjoy. Write for descriptive literature.

GENERAL ELECTRIC VAPOR LAMP COMPANY

916C

Presenting FEDDERS Series 4 UNIT HEATERS

U. S. Patents 1,970,-105; 2,025,426. Other Pats. Pending

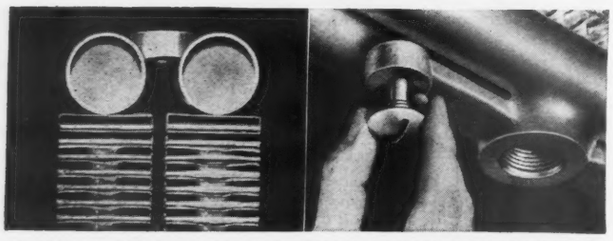


New, exclusive Series 4 Double Headers for unusually free steam flow, improved Full-Floating Mountings, tubes with aerodynamically correct 3 to 1 streamline ratio and patented saddle fins prevent differential expansion stresses, improved mono-piece cabinet design with integral mouldings, those are some of the features of Fedders New Series 4 Unit Heaters.

Write for Bulletin 537 showing inside story of the new Series 4 Line.

Fedders Exclusive Series 4 cylindrical Double Headers and Saddle Fins

Series 4 Full Floating Element Mounting eliminates expansion stresses



FEDDERS MANUFACTURING CO.
57 Tonawanda St., Buffalo, N. Y.

Please send copy of Series 4 Unit Heater Bulletin 537 to my personal attention

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Concern .....

Street .....

City .....F 10-38

PRINTOMATIC SCALE-

SAVES *Time, Errors, Arguments* IN FOUNDRY

● Men who clean and finish castings in the Whitin Machine Co., Whitinsville, Ohio, place them in a metal pan, along with an identifying ticket. The pan of castings is carried on a conveyor to a Fairbanks scale equipped with a Printomatic attachment. When the pan approaches the scale, the operator releases a foot lever which permits but one pan at a time to rest on the scale, inserts the identifying ticket, presses a button, and the correct weight is automatically *printed* on the ticket. There are no errors in reading —none in recording. Approximately 1000 weighings per day are accomplished speedily and with absolute fairness to both company and men.

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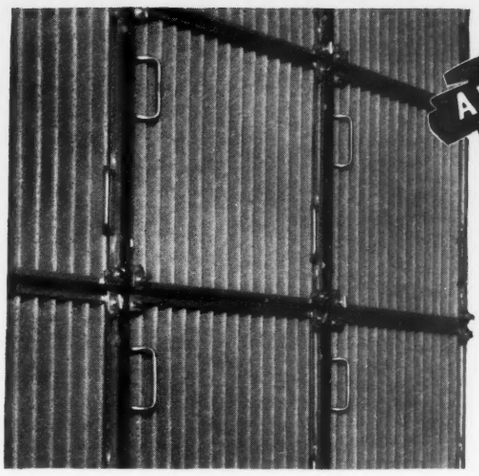
Scales

CONSTANTLY IMPROVED TO KEEP PACE WITH NEEDS OF INDUSTRY



AIRMAT PL-24 FILTER—The outstanding Dry filter widely used in central system air conditioning and for a wide variety of industrial applications where a high efficiency in dust removal—particularly smoke carbon particles, is essential. Utilizes the famous Airmat Filter Paper which can be easily and inexpensively renewed. Outstanding for its compact design; convenient, inexpensive maintenance. Write for Bulletin No. 230 A.

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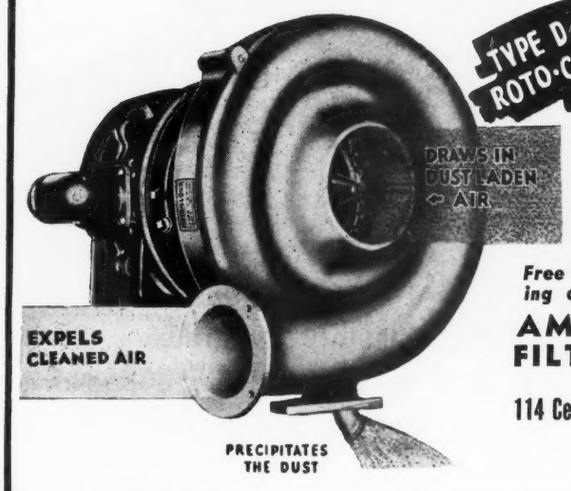

TYPE D ROTO-CLONE combines exhauster and dust collector in a single unit. Saves space, piping and power since it can be installed at or near the dust producing equipment. Compact; easy to install; unaffected by temperatures; constant high efficiency in dust separation under all operating conditions. Write for bulletin No. 272.

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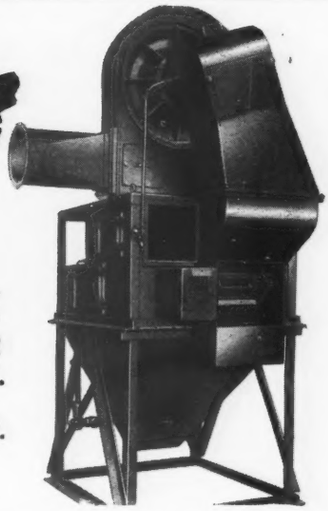
Incorporated
114 Central Ave., Louisville, Ky.



TYPE W ROTO-CLONE combines a water spray with dynamic preciptation for handling dusts inclined to cake or pack. Collected material is delivered in the form of sludge or slurry. Particularly well suited to applications in foundry operations and in ceramic, mining, chemical and similar industries where positive collection of dust must be accomplished with unvarying performance. Write for Bulletin No. 274.

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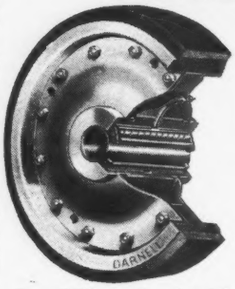

Darnell Wheels offer a long life of efficient service with increased satisfaction in savings effected.

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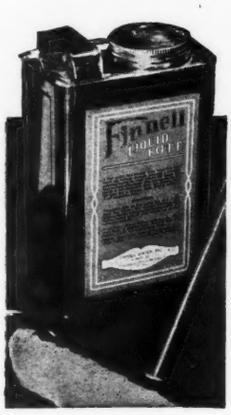

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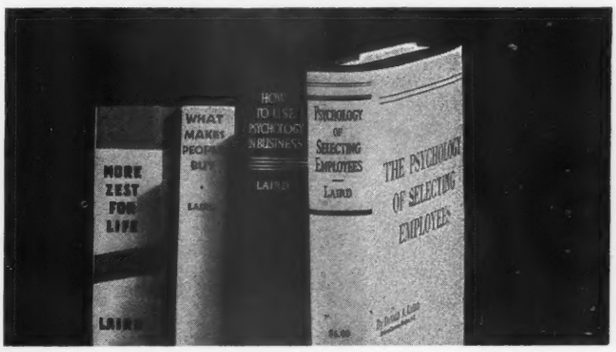

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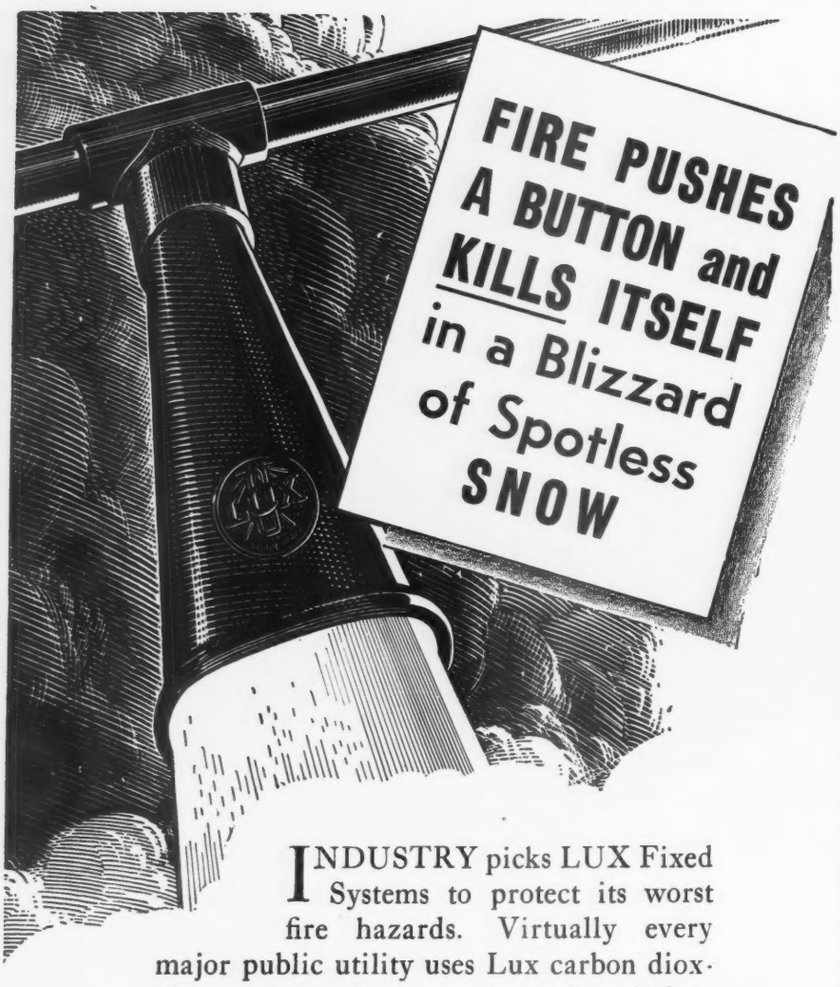

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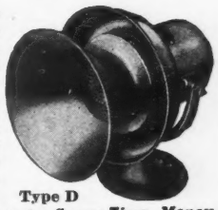

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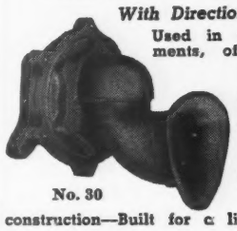

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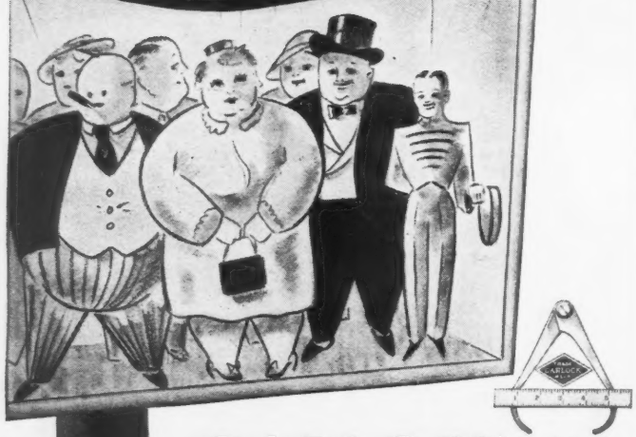

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GARLOCK 90—Coil GARLOCK 92—Spiral
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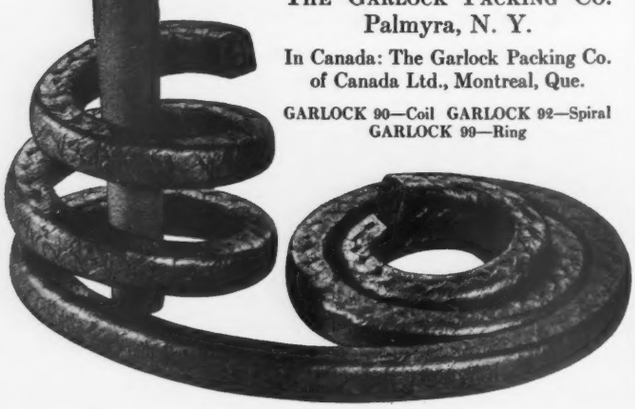

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500	450	G. E.	MT–412
600	514	West.	CW
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100	720	G. E.	TS
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300	720	G. E.	ATI
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Write for a copy of our 24-page Stock List.
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60x140 without craneway.
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"Anything containing IRON or STEEL"

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is
Quick-Action
Advertising

INDEX TO ADVERTISEMENTS

	Page
Acme Steel Company	147, 156
Ahlberg Mfg. Co.	insert, 127, 128
Alan Wood Steel Co.	95
Allen, Oliver Field	170
Allis-Chalmers Mfg. Co.	insert, 19, 20, 105
Aluminum Co. of America	110
American Air Filter Co	167
American Blower Corp.	103
American Engrg. Co.	149
American Hot Dip Galvanizers Assn.	163
American Mutual Liability Ins. Co.	16, 17
American Screw Co.	99
Associated Engineers, Inc.	170
Automatic Transportation Co.	153
Baker-Raulang Co.	122
Benjamin Electric Co.	132
Birdseye Electric Co.	156
Black & Decker Mfg. Co.	175
Bradley Washfountain Co.	134
Browning Crane & Shovel Co.	134
Buffalo Forge Co.	37
Bull Dog Electric Prod. Co.	25
Carnegie-Illinois Steel Corp.	38
Century Electric Co.	39
Clarage Fan Co.	144
Colt's Patent Fire Arms Mfg. Co.	27
Consolidated Expanded Metals Co.	116
Continental Screw Co.	99
Coppus Engrg. Corp.	139
Corbin Screw Corp.	99
Crane Co.	107
Darnell Corp., Ltd.	168
Dayton Safety Ladder Co.	144
Delta Mfg. Co.	158
De Vilbiss Co.	118
Disston & Sons, Inc., Henry	113
Ducommun, M.	171
Eagle-Picher Lead Co.	30
Electric Storage Battery Co.	91
Elwell-Parker Electric Co.	97
Exposition of Power & Mechanical Engineering, 13th National	140
Fairbanks, Morse & Co.	166
Fedders Mfg. Co.	166
Federal Electric Co., Inc.	171
Felters Co.	34
Finnell Systems, Inc.	169
Flexible Metal Hose & Tubing Institute	143
Garlock Packing Co.	172
Gaylord Container Corp.	33
G. E. Co. (Incandescent Lamp Div.)	120
G. E. Vapor Lamp Co.	165
Goodrich Company, B. F.	3, 115, 176
Goodrich Electric Co.	138
Goulds Pumps, Inc.	160
Graton & Knight Co.	151
Graybar Electric Company	7, 168
Grinnell Co.	18
Gulf Oil Corp.	8
Hyatt Roller Bearing Co.	5
Independent Pneu. Tool Co.	123
Industrial Brownhoist Corp.	164
Industrial Controller Div. of Square D	3rd Cover
Johns-Manville, Inc.	101
Johnson Gas Appliance Co.	152
Jones & Laughlin Steel Corp.	119
Kidde & Co., Walter	170
Koppers Co.	insert, 109
Lamson Co.	21
Lewis Co., G. B.	171
Link-Belt Co.	4
Macwhyte Co.	121
Maple Flooring Mfrs. Assn.	155
Maryland Metal Bldg. Co.	148
Massachusetts Development & Industrial Commission	161
Master Electric Co.	14, 15
McCaskey Register Co.	24
McGraw-Hill Book Co.	133, 169
Methods Engrg. Council, Inc.	170
Meylan, A. R. & J. E.	171
Minnesota Mining & Mfg. Co.	146
Modine Mfg. Co.	10, 11
Mogensen, Allan H.	170
Morse Chain Co.	4th Cover
Nat'l Screw & Mfg. Co.	99
New Departure Mfg. Co.	42
Nicholson File Co.	141
Nitrose Co.	160
Norton Co.	125
Oilgear Co.	152
Osborn Mfg. Co.	9
Page Fence Ass'n.	114
Pangborn Corp.	162
Paraffine Companies	159
Parker-Kalon Corp.	99
Philadelphia Gear Works	157
Pneumatic Scale Corp.	145
Pure Oil Co.	171
Reeves Pulley Co.	36
Reliance Electric & Engrg. Co.	6
Rhoads & Sons, J. E.	129
Richards-Wilcox Mfg. Co.	23
RLM Standards Institute	93
Rockbestos Products Corp.	26
Russell, Burdsall & Ward Bolt & Nut Co.	99
Ryerson & Son, Inc., Jos. T.	130
Scott Paper Co.	40
Scully Steel Products Co.	137
Searchlight Section	173
Sellstrom Mfg. Co.	144
Service Section	171
Shell Union Corp.	111
Shepard Niles Crane & Hoist Corp.	160
Skilsaw, Inc.	150
Spencer Turbine Co.	136
Square D Company	3rd Cover
Standard Oil Co. of Indiana	2nd Cover
Standard Pressed Steel Co.	140
Texas Company	35
Thermoid Rubber Div. Thermoid Co.	32
Tide Water Associated Oil Co.	12, 13
Toledo Scale Co.	162
U. S. Rubber Co.	28, 29
U. S. Steel Subsidiaries	38, 137
Veeder-Root Inc.	172
Victoria Paper Mills	164
Waldron Corp., John	164
Webb Co., Jervis B.	124
Wellington Sears Co.	142
West Disinfecting Co.	157
Westinghouse Elec. & Mfg. Co.	22, 31
Westinghouse (Lighting Div.)	117
Wheeling Corrugating Co.	135
Wing Mfg. Co., L. J.	131
Wood's Sons Co., T. B.	136
Yale & Towne Mfg. Co.	126
INDUSTRIAL CONSULTANTS	170

SEARCHLIGHT SECTION

Classified Advertising

Business Opportunities	173
Employment Service	173
Positions Vacant	173
Positions Wanted	173
Selling Opportunities	173
Wanted to Purchase	173
Equipment New and Used	173
Electric Generator & Motor Co.	173
Electric Service Co., Inc.	173
Iron & Steel Products Co.	173
Nussbaum & Co.	173

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World's Largest Manufacturer BLACK & DECKER **of Portable Electric Tools**

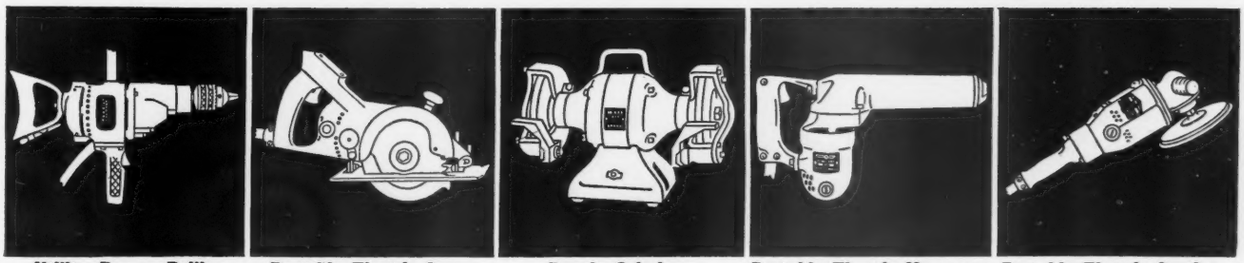
You'll "Reach" when you see HOLGUN!

Yes sir—the minute you "palm" one of these new Black & Decker ¼" HOLGUNS, you'll want it. Not only for its smooth power, and new design, but because its very "feel" and appearance suggest the many drilling jobs you can handle quickly and easily.

HOLGUN has everything that's made Black & Decker famous for fine tools . . . perfect balance—a comfortable "pistol-grip and trigger switch" that fits the hand—left or right.

HOLGUN is a heavy duty tool yet weighs only 2¾ pounds. It's only 6¾ inches overall, and with its minimum spindle off-set permits drilling in the tightest spots. HOLGUN is easily taken down, and all vital parts are readily accessible.

HOLGUN is *one* tool you can't afford to be without. So phone your Jobber for a demonstration—now. Or write to us for details. The Black & Decker Mfg. Co., 719 Penna. Ave., Towson, Md.



Utility Power Drills | **Portable Electric Saws** | **Bench Grinders** | **Portable Electric Hammers** | **Portable Electric Sanders**

Tempest in a Tunnel for Safety in the Sky

A typical example of Goodrich development in rubber

THIS man is manufacturing a winter storm. In this refrigerated wind tunnel in the Goodrich plant, model airplanes and wing sections can be treated to freezing rain, sleet and ice conditions as encountered in flying.

Ice forming on airplane wings used to cause serious delays. Goodrich developed a rubber device that breaks it off as it forms. A rubber covering fits tightly over leading edges, contains a series of flat tubes that are inflated alternately, to produce a changing surface that breaks the ice. Modern transport planes carry these ice removers in all seasons when there is the slightest danger of ice formation.

Goodrich engineers continued to use this stormy tunnel in development work to keep pace with improvement in planes. They invented a way to bathe moving propeller blades with anti-freeze . . . they developed a means of riveting, to attach ice removers to metal planes, working from *one side only*. . . and they improved the product itself so that one sent in recently, after 1000 hours of service, was found to have exactly the same properties as when the rubber was new. . . Aeronautical men don't have to be told how continuous and how productive Goodrich research work is.

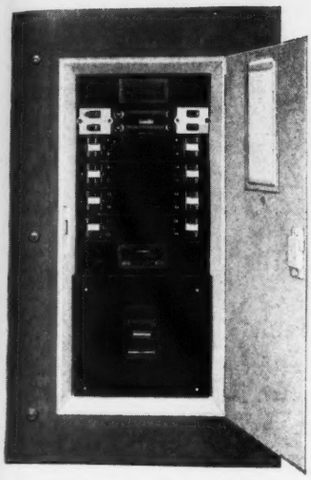
It's the Goodrich way of keeping up-to-date, and *no Goodrich product* is too standardized to get this same sort of development work. It applies to rubber belts, to hose, to rolls, to rubber linings, to other products that can save you money by better performance in your plant. See your Goodrich Distributor. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

Goodrich

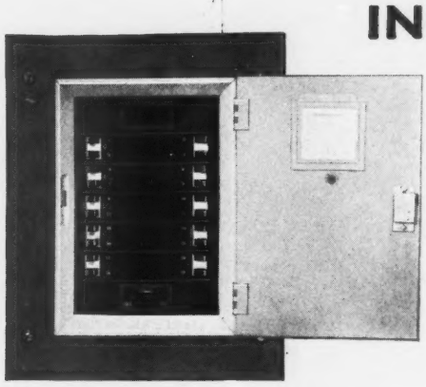
ALL *products problems* IN RUBBER

Another story of Goodrich development work appears on page three

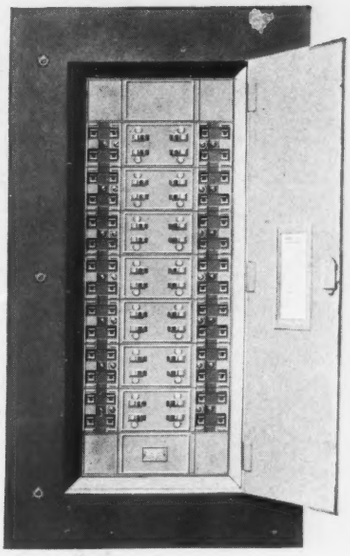
THERE IS A SQUARE D PANELBOARD TO MEET *Every* REQUIREMENT WITHIN THE INDUSTRIAL PLANT



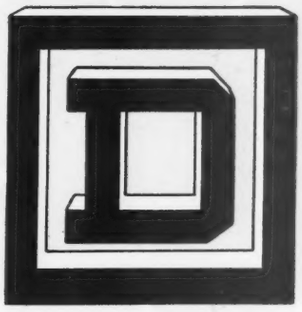
Multi-breakeR Lighting Panelboard with main circuit breaker.

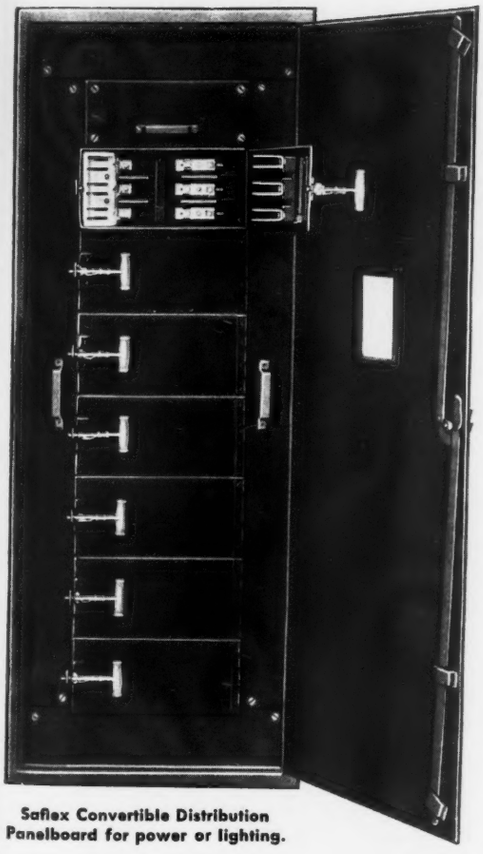


Multi-breakeR Panelboard for lighting and appliances.



Fusible Lighting Panelboard.



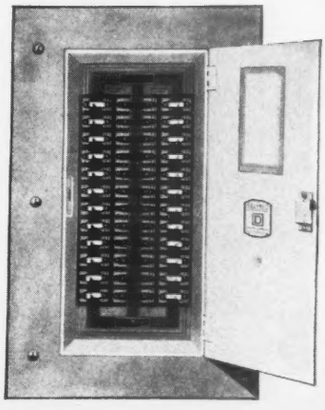


Saflex Convertible Distribution Panelboard for power or lighting.

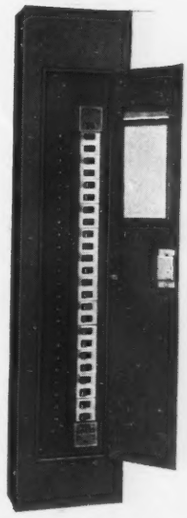
Adequate power and lighting distribution is essential to the factory, laboratory and office of the modern industrial plant. The Square D line of panelboards is complete. It meets every requirement.

Fusible or circuit breaker panelboards; narrow type panels for mounting in I-beams or on columns; the new Multi-breakeR panelboards which provide branch circuit switching and circuit breaker protection at a new low cost.

Square D electrical equipment is available through electrical wholesalers everywhere.



Circuit-breaker Panelboard Type L, quick make, quick break, double break branches.



Multi-breakeR Panelboard Narrow Column Type LX.

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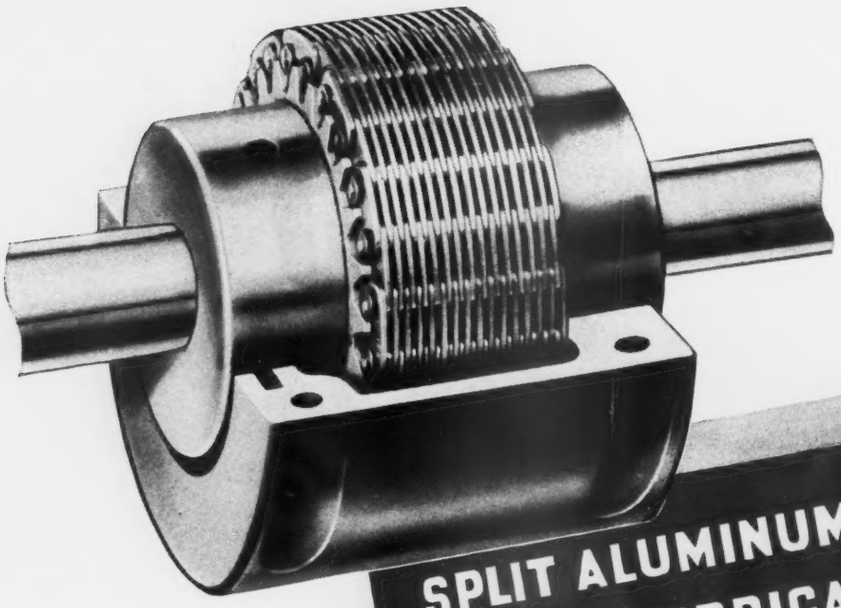

SPLIT ALUMINUM COVER HOLDS LUBRICATION IN MORSE *Standard* COUPLINGS

AND THAT'S JUST ONE OF MANY REASONS *why* MORSE COUPLINGS ARE *Better*

MORSE MORFLEX COUPLINGS

Solid blocks of rubber form the flexing medium of this coupling. Between two forged steel hub members is the floating center connected through resilient, live rubber trunnion blocks. Compensates for maximum misalignment without power loss. No metal on metal movement. Requires no lubrication, no protection from dirt, dust, or water.

The aluminum cover of the Morse Standard Coupling fits tight —on a ground hub at one end and on a grease seal at the other to permit maximum flexibility yet prevent leakage of lubricant. The coupling operates completely lubricated at all times, insuring long life and freedom from excessive wear.

The construction of Morse Standard Couplings—two facing steel sprockets, especially treated for longer wearing, longer life, wrapped in specially developed coupling Morse Chain—means greater ruggedness and stamina without sacrificing flexibility and the cushioning action to soak up shocks and strains from motor or machine. Finished cover faces permit easy check-up on alignment. A single pin, easily withdrawn or inserted, connects or disconnects the coupling in a moment's time. Morse Standard Couplings may also be supplied with cover of steel or cast iron. Or in larger sizes, stationary cases may be used. Have the Morse man in your territory show you *all* their many advantages!

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS KELPO CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.